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QUARTERLY

OF THE

National Fire Protection Association

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60 BATTERYMARCH STREET, BOSTON, MASS.

National Fire Protection Association

INTERNATIONAL

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Over 4,000 Associate Members.

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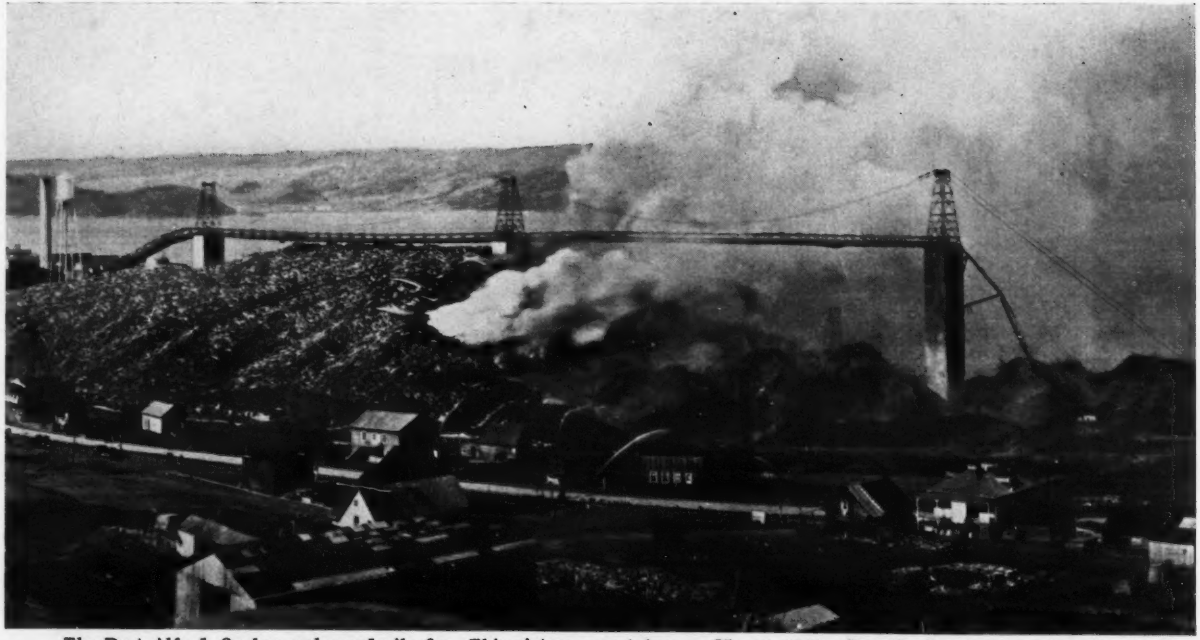
Reports of fires appearing in the Quarterly are copies of or extracts from written reports forwarded to the Association. This Association, as a body, is not responsible for the statements or opinions of any of its members.



The Port Alfred, Quebec, pulpwood pile fire. This picture was taken on May 3, 1932, after the fire had been burning for five days. A complete report of this fire appears on page 63.

The Quarterly

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Deflation and Fire Protection. The general business deflation that is involving almost every phase of activity inevitably affects fire protection. Fire protection itself, having experienced no special inflation during business prosperity, cannot now be deflated in the proper meaning of the word, but the fact remains that expenditures for fire protection, both public and private, are being materially reduced. It is most unfortunate that economy programs are in some cases reducing fire protection which even in boom times was not above the absolute minimum. Reduction in expenditures for fire protection, both public and private, is apparently to a certain extent inevitable. There are, however, many opportunities to influence the direction of economies in the interest of greater efficiency, and by keeping the necessities of fire protection in mind, to secure some measure of fire safety.

Sometimes seemingly minor details, involving no appreciable expense, have a great influence on fire protection. An example brought out in the discussion at the recent Atlantic City meeting was the practice with respect to vacant buildings where automatic sprinkler systems are shut off. By a little forethought, instead of leaving the system wholly useless, the valves can be left so that, in case of fire, pumpers can couple to the fire department connection of the system.

In public fire protection ill advised measures of economy may have most serious consequences. In all too many communities, when confronted with an increasing fire loss, the tendency has been in past years to meet the situation by adding apparatus and men to the fire department, without doing anything to get at the fundamental causes of the fire loss. In recent years the fire prevention function of fire departments has been given increasing attention, as attested by the number of fire departments that now have fire prevention bureaus. It is in the control of hazards, the investigation of suspicious fires and similar activities that the taxpayer's dollar gives the greatest return in reduced fire losses. If fire department curtailment becomes necessary, the fire prevention activities should be the last to be affected.

The present careful scrutiny of expenses of all kinds may lead to increased efficiency of fire protection agencies and to a more intelligent understanding of fire protection. N.F.P.A. members who are alert to the situation can render a major service in influencing an intelligent application of any necessary economies, and in pointing out that proper expenditures for fire protection are essentially savings, as fire protection holds the fire waste within bounds.

* * * * *

Wooden Shingles Burn. Notwithstanding the specious argument of lumber interests that the well-known hazard of the wooden shingle roof is eliminated by the use of red cedar shingles of a specified thickness and method of sawing, it is an established fact that wooden shingles do burn. This fact is so abundantly demonstrated by the fire record that further evidence may seem superfluous, but a fire recently reported to the N.F.P.A. should be added to the record as a costly illustration of this hazard.

The building involved in this fire was a resort hotel constructed of wood to harmonize with its surroundings. The roof covering was red cedar shingles, of the extra thick type known as shakes and supposedly because of their thickness less susceptible to ignition than ordinary shingles. Asbestos insulation was placed between the shingles and the wooden roof deck. A complete system of automatic sprinklers had been installed inside the building, and the roof was protected by a 3-in. perforated pipe sprinkler system extending around the chimney, which was located at the highest point of the roof. The chimney, of such substantial construction that there was no suspicion of ignition by sparks or heat through its walls, was equipped with a screen to prevent the passage of burning embers, but evidently not effective in preventing the ignition of the wooden roof by sparks or flame.

Snow six to eight inches deep covered the roof on the day of the fire last January, except for a few feet at the peak around the chimney. At 3 A.M. the night watchman, whose rounds covered the exterior as well as the interior of the building, saw a small fire on the roof a short distance from the chimney. He immediately gave the alarm, and the well-equipped private fire brigade responded promptly. However, before the firemen reached the burning area or the open sprinkler system was operated, the fire had worked down into inaccessible hollow spaces in the roof, which were not fire stopped. The fire did not extend below the roof, owing to the efforts of the firemen and a layer of gypsum plaster board forming the ceiling. The automatic sprinklers were isolated from the fire at the start, but opened later and prevented the spread of the fire into the attics of adjoinings wings of the building. The roof was partially destroyed and there was heavy smoke and water damage. The loss was over $90,000.

A New Type of Insurance Inspection. Mass action by fire insurance company representatives concentrating in a single community for a short period has a psychological and publicity value not obtained from the same amount of similar scattered activity. This fact has been recognized by our energetic member, Richard E. Vernor of the Western Actuarial Bureau, in organizing town inspections by fire insurance company field representatives in the middle western states. Most N.F.P.A. members are familiar with Mr. Vernor's plan, which, in addition to local publicity, fire prevention talks before the schools and civic clubs, and other educational activities, includes a fire hazard inspection of every mercantile, manufacturing and public building in the community. After these inspections a report is given to each property owner detailing the defects in his building, and subsequent check-ups show that a substantial proportion of these fire hazard recommendations are complied with.

A further development of this idea is reported from Louisiana, where the Association for the Reduction of Fire Loss has been organized by fire insurance field men, including a number of representatives of the Louisiana Rating and Fire Prevention Bureau (member N.F.P.A.). The primary objective of the Louisiana plan, in addition to stimulating local interest and improving the fire defenses of the community, is to eliminate over-insurance as an incentive to moral hazard fires. The work done in April, when some forty representatives of the Association spent four or five days in Monroe, La., shows the typical plan of operation which has been followed in several Louisiana cities. Monroe is a city of 26,000 population (with West Monroe about 33,000), where, as in other communities, business conditions have not been favorable for some time, property has depreciated in value, and the fire loss has reflected an increasing moral hazard. The problem was most acute in heavily mortgaged speculative residential property.

The plan included an approximate appraisal of the present cash value of every property in the city, a listing of these values, and securing the agreement of local insurance agents, mortgage bankers and others, all of whom offered whole-hearted coöperation, not to place insurance in excess of the stated values (nor over three-quarters of value in certain classes of property), and to coöperate in other ways to control over-insurance.

One of the suggestions applicable particularly to West Monroe was that "the authorities, after each fire, promptly hold a formal investigation or inquest, taking testimony from all persons that might have any knowledge concerning the fire with the announced intention of fixing responsibility and preferring charges." Another suggestion adopted at once was the appointment of a fire prevention committee of "representative business men and professional men, not engaged in the insurance business, who could sponsor and support fire prevention efforts from the viewpoint of the general welfare of

the community and not biased by possible benefits to any particular business." Investigations of fire department equipment and methods, water supplies, ordinances, and other features were made and appropriate recommendations prepared.

It is clear that if insurance in excess of present cash value can be eliminated as an incentive to moral hazard fires, a substantial reduction in losses will ensue. The plan described above seems to be a logical method of handling this phase of the community fire hazard. It is interesting to note that the same idea is being applied in other territories, as an example of which may be cited the inspection of Waco, Texas, to determine insurable values, in progress at this writing.

* * * * *

A Measure of Success. When the N.F.P.A. launched its field service program in 1924 a group of fifty cities were selected in which for the most part high fire losses were evident. While the field work has now embraced over three hundred cities, this original group has received steady attention. Now that eight years of the field service effort have elapsed a comparison of the four-year fire records of these fifty cities, comparing the total fire losses of the periods 1924-27 and 1928-31 should provide some measure of the effect of persistent field work in these communities.

There are 454 cities over 20,000 population in the United States with a total population of 51 million. The fifty cities in question have a total population of 14 million, or 27 per cent of the total. Fire loss in the 454 cities for the four-year period 1924-27 was $629,033,000, and for the four-year period 1927-31 was $562,012,000, a reduction of 67 million dollars. The fire loss in the fifty cities for the period 1924-27 was $198,435,000, and for the period 1928-31 was $168,954,000, a reduction of approximately 30 million dollars. It appears to us significant that the reduction in this group of cities representing 27 per cent of the population was 45 per cent of the total reduction. The more rapid reduction of losses in this selected group offers evidence that aroused fire prevention consciousness does have a substantial benefit in reduced fire waste.

Meetings of Board of Directors.

Atlantic City, May 10, 1932.

Members Present.

Frederick T. Moses, President
Sumner Rhoades, Vice-President
H. L. Miner, Vice-President
Dana Pierce, Past President
Franklin H. Wentworth, Managing Director

Eugene Arms, Chicago
Frank R. Bradford, Boston
Eugene Chrystal, Rochester
Geo. W. Elliott, Philadelphia
C. H. Haupt, Elizabeth, N. J.
S. D. McComb, New York
C. W. Mowry, Boston
S. L. Nicholson, New York
C. W. Pierce, New York
D. J. Price, Washington
Benjamin Richards, Chicago
R. E. Vernor, Chicago

Business Transacted.

The annual report of the Chairman was amended and approved.

The annual report of the Treasurer was approved.

The report of the special subcommittee on technical committee jurisdiction presented by Chairman Eugene Arms was approved.

The report of the Advisory Committee of the Board on Fireproofing Processes, presented by Chairman Dana Pierce, was received and its presentation to the Association recommended. The committee was continued.

Several communications received were referred to the incoming board.

Boston, Monday, June 13, 1932.

Members Present.

Albert T. Bell, Chairman
Sumner Rhoades, President
George W. Elliott, Vice-President
Harold L. Miner, Vice-President
Franklin H. Wentworth, Managing Director

Frank R. Bradford, Boston
Arthur H. Kehoe, New York
S. L. Nicholson, New York
C. W. Pierce, New York
David J. Price, Washington
A. R. Small, New York
Richard E. Vernor, Chicago

Business Transacted.

Following recommendation of annual meeting, the following officers were elected for the fiscal year: President, Sumner Rhoades; Vice-President, George W. Elliott; Vice-President, Harold L. Miner; Chairman Board of Directors, Albert T. Bell; Managing Director, Franklin H. Wentworth.

The Chairman appointed the following Advisory Committee for the Association year to serve with himself as Chairman: Sumner Rhoades, H. L. Miner, George W. Elliott, C. W. Pierce.

Selection of place of 1933 annual meeting of the Association was deferred until the mid-winter meeting of Directors.

The budget submitted by the Managing Director was approved, subject to the following action and amendments:

(a) Reduce salaries of all Association employees (except the electrical field engineer) ten per cent for one year beginning July 1, 1932.

(b) Consult Committee on Electrical Field Service concerning reduction of salary of field engineer.

(c) Omit printing membership directory for year 1932.

(d) Confer with agents of Public Service Building concerning reduction of rent for Association offices.

Frank R. Bradford of Boston and C. W. Pierce of New York were selected to complete the Nominating Committee for 1933.

Technical Committee Affairs.

Committee on Field Practice.

In accordance with the vote of the annual meeting, the Committee submitted for approval by the Board of Directors the editorial and other minor changes referred to by Chairman Daniel in presenting the report. These changes included:

A rearrangement of the classification table, with segregation of wheeled extinguishing devices.

Inclusion of new 10-gallon foam extinguishing device.

Clarification of wording on carbon dioxide extinguishers, to indicate that only those with insulated discharge horn are suitable for use on electrical fires.

Revision of maintenance instructions on dry chemical type extinguisher to make these uniform with similar instructions for other types.

Other minor editing not changing intent.

The amendments recommended by the committee were approved and because of the considerable revisions of the text it was voted to recommend to the National Board of Fire Underwriters an immediate reprinting of the regulations.

Committee on Garages.

In accordance with the authorization of the annual meeting, the committee submitted for approval the following changes in the 1932 report.

31. STANDPIPES (e). In third line insert the words "Class B" so this will read, "approved Class B wheeled fire extinguishers, etc."

32. FIRST AID FIRE APPLIANCES. Revise to read:

Extinguishers shall be installed and maintained in accordance with the Regulations on First Aid Fire Appliances. Approved Class B extinguishers in such numbers as will meet the requirements of Class III occupancies shall be provided in all areas, including decks,

galleries, basements and storerooms, containing flammable liquids or greases. At any gasoline and oil filling station there shall be at least one approved Class B unit. Offices and storerooms other than those noted shall be provided with approved Class A or A-B units to meet the requirements for Class II occupancies.

Note:—The Regulations on First Aid Fire Appliances give complete information on installation and maintenance of various types of extinguishers. They provide that in both Class II and Class III occupancies extinguisher units shall be so located that a person will not have to travel more than 50 ft. from any point to reach an extinguisher. Extinguisher installations are subject to the approval of the inspection department having jurisdiction, which may require one unit (one or two extinguishers depending upon capacity) for each 2500 sq. ft. floor area, and additional units for the protection of any special hazards.

The recommendations of the committee were approved.

Committee on Flammable Liquids.

The committee requested the approval of the Board of Directors for the deletion from the Regulations on Oil Burning Equipments rule 137(a). The secretary of the committee advised that favorable replies on this item had been received from a large majority of the committee.

The original rule 137(a) specified clearances between smokepipes and woodwork, and similar fire protection details. The oil burner manufacturers, while agreeing as to the necessity of proper clearances irrespective of the type of fuel used, protested the inclusion of these provisions in the oil burner rules, as no similar material has been circulated relative to coal burning furnaces. The committee in its 1932 report accordingly deleted the detailed requirements and inserted a reference to the National Board Building Code. Subsequently it developed that the National Board Code makes more drastic requirements for oil than for coal burning furnaces and that while in the next edition these requirements are to be made uniform, irrespective of the fuel used, there is no immediate prospect of a new edition of the Code. Accordingly the committee now deletes the reference to the National Board Building Code and is silent on this subject.

It was suggested that it would be desirable to publish an informative appendix to the regulations, giving the standard requirements for furnace installations. So handled, this pamphlet could continue to carry this important information to the public without discrimination as to type. There not being time to work out the details or secure committee approval prior to the Directors' meeting, it was suggested that the committee be authorized, if desired, to include such an informative appendix, consistent with existing N.F.P.A. standards.

The deletion of rule 137(a) was authorized and the suggestion for an informative appendix was approved.

Committee on Gases.

In accordance with the authorization of the annual meeting, the Committee on Gases submitted for approval revised text for Section 39 of the Recommended Good Practice Requirements for City Gas.

This text is essentially the same as that tentatively adopted in 1931 (Proceedings 1931, page 301, rule 65), but is changed in several minor details. The principal changes are:

(1) Provision for gas fired warm air furnaces, similar to provision for other types of systems.

(2) Change in ratio of flue area to B.T.U. gas input from 1 sq. in.: 5000 B.T.U. to 1 sq. in.: 7500 B.T.U.

(3) Deletion of former rule prohibiting vents from gas appliances entering common chimney flue serving devices burning other types of fuel.

The recommendation of the committee was approved.

Committee on Building Construction.

It was voted to recreate and continue the Committee on Building Construction, the new personnel to be selected in conference with the president and submitted to the Directors at the winter meeting with an outline of the proposed scope of the committee's activities.

An invitation from the Division of Trade Standards of the U. S. Bureau of Standards to be represented at a general conference to consider the adoption of a proposed commercial standard for Oil Storage Tanks was discussed, and it was voted to appoint members H. L. Miner and A. R. Small as N.F.P.A. representatives to the said conference with the request that they make full report to the winter meeting of the Board of Directors concerning the same.

Fireproofing Processes.

The subject of Fireproofing Processes, upon which there exists a special advisory committee of the Board, was discussed, and it was voted to request the said committee to give further consideration to the matter in the light of this discussion, and to furnish to the winter meeting of the Board recommendations for desired action on this subject.

Miscellaneous.

The application of the Independent Automatic Sprinkler Association for membership and representation upon technical committees was laid upon the table.

A communication from the Association of Electragists respecting interim revisions of the National Electrical Code was discussed and referred to the Managing Director for reply.

The renewed application of the Electrical Guild of North America for representation upon the Electrical Committee was considered and the Managing Director was requested to reaffirm the previous action of the Board.

The request of the International Brotherhood of Electrical Workers for representation upon the Electrical Committee was considered, and the Managing Director requested to inform this member that it is inadvisable to grant its request because of the present careful constitution of the Electrical Committee to provide balanced representation satisfactory to and approved as a sectional committee by the American Standards Association.

The list of proposed changes in technical committee personnel was referred to the President for approval.

The proposed resignation of the American Institute of Architects from membership was not accepted and the matter referred to the Managing Director.

The Managing Director was requested to convey to Robert Palm, retiring technical committee chairman, the sincere appreciation of the Directors for his long and devoted service to the Association in the evolution of its standards.

Liability for Fire Loss.

Decision of Supreme Court of Canada.

An interesting case of legal liability to neighbors for damage done by a fire communicating to their premises has recently been decided by Canada's highest court. Under this decision the Canadian city of Port Coquitlam must pay to three complaining citizens something like $65,000 for damage to their property caused by fire starting in city property. The city fought the case stubbornly from the lower court through the Supreme Court of British Columbia to the Supreme Court of the Dominion, which awarded the complainants damages.

The city of Port Coquitlam owned a wooden building for its fire hall in which its fire and police chief, McKinley, made his home, with his wife and child, living in rooms at the rear of the second story, one of which was the kitchen. The fire resulted from the improper installation of the smoke pipe from the kitchen stove, which passed through a wooden ceiling, thence through an attic and out through a wooden roof. A municipal by-law required that in such case the pipe should be "enclosed in brick or tile walls with a space of at least three inches between the enclosing walls and the smoke pipe." Non-compliance with this by-law, and that compliance would have prevented the escape of the fire, were admitted.

Some time before the fire occurred, the stove had been removed by Chief McKinley and another substituted, and one section of the pipe shortened in a manner which, it was alleged, added to the risk of fire. The attorneys brought into the case an old law of George III presumably in force in British Columbia, by which it was provided:

> No action, suit, or process whatever, shall be had, maintained or prosecuted against any person in whose house, chamber, stable, barn or other building, or on whose estate any fire shall.....accidentally begin.

But the trial judge directed the jury that the fact that the fire first broke out in the city's premises was *prima facie* evidence of negligence and that the onus was on the city to acquit itself of liability by showing that the fire began accidentally. He refused to direct that the city was not liable for anything resulting from the act of McKinley in making the pipe less safe.

The Supreme Court held that there had not been misdirection as to the city's liability for the act of its servant McKinley. The city being responsible for the setting up in the first place of the stove, it was within the normal scope

of McKinley's duty as the city's servant to take notice of anything calculated to make the use of it a source of danger; McKinley's knowledge of what was done when the stove was changed was the knowledge of the municipality because his occupation was its occupation, and therefore McKinley's negligence was the city's negligence. The court held, further, that owing to the jury's finding that the fire originated from cinders or sparks escaping from the stove pipe into the attic, and in view of its own by-law and of the fact that the fire would not have occurred if the by-law had been complied with, the city was *prima facie* liable for not having taken reasonable means to prevent harm to its neighbors by the escape of fire it had authorized.

(Canadian Law Reports: The Supreme and Exchequer Courts of Canada: Part III, March 31, 1923. City of Port Coquitlam vs. Wilson and others.)

The Los Angeles Fire Department.

The modern fire department has progressed far beyond its old function as a purely fire extinguishing agency. There are several fire departments, both in the East and the West, that might be selected to illustrate this progress. Los Angeles furnishes an outstanding example of the modern fire department that has reached an advanced position and has consistently made available to other communities the experience gained in its development.

It provided, for example, the principal background for the analysis of the fireman's job made by the Federal Board for Vocational Training which has furnished the material for a nation-wide program of fire department education and training work in coöperation with the International Association of Fire Chiefs. Much of the credit for this and other features is, of course, due to the interest and enthusiasm of Chief R. J. Scott and the other officers of the department.

Los Angeles is a city of 1,231,000 population and occupies 441 square miles. While closely built in some sections, it has suburban areas with much open country. Protection is complicated by the fact that seashore sections, San Pedro and Venice, are 15 to 20 miles from the center of the city. The fire department operates under a Board of Fire Commissioners appointed by the Mayor with the consent of City Council and in most respects is similar to many other fire departments. It has 1718 men distributed among 72 engine companies, 20 ladder companies, 8 salvage companies, 4 rescue companies, 3 fireboats, 13 companies doing miscellaneous services, and the several functional divisions of the department. Affiliated are also 12 entirely volunteer companies serving isolated suburban centers. Two bungalow type stations in outlying districts, recently completed, are not as yet occupied.

The department has the usual administrative and executive personnel, including divisions for accounting and other clerical work, repair and main-

Los Angeles Fire Department Photo.

The Los Angeles Fire Department drill tower. Seven stories high, built substantially of reinforced concrete, it embodies facilities for instruction and practice in all fire department operations.

tenance of apparatus, and the operation and maintenance of the fire alarm system. Persons studying fire department operations would find much from which to profit in the operation of the fire alarm system, the fireboats, and the rescue and special service companies of the department. Particular attention should be called to the salvage companies. Los Angeles was the first of the larger cities to recognize the importance and value of salvage operations as a part of regular fire department work. Salvage work by truck (ladder) companies which carry covers and salvage tools, supplements the activities of the salvage companies and makes for efficient fire fighting methods.

The Fire College, and the Bureaus of Fire Investigation, Fire Prevention and Public Relations are given special mention as the emphasis on the work of these divisions illustrates most strongly the transition of the modern fire department from a fire extinguishing to a fire prevention agency.

Fire College.

Los Angeles is particularly noted for the extensive drill and training facilities provided. There is an excellent drill tower and a regular drill school wherein basic training and drill work are given every fireman. The Fire College courses provide advanced instruction for officers and men, particularly in technical matters. Courses have been prepared covering, among other things,

Los Angeles Fire Department Photo.

Asbestos suits for use in fighting oil fires are a part of the equipment of certain companies that regularly respond to alarms in the oil districts.

such topics as: Apparatus and Equipment, Arson, Brush Fires, Building Inspection, Dust Explosions, Hydraulics, Fire Alarms, Making Reports, Fire Fighting Operations, Salvage, Use of Explosives, Ventilation, Oil Storage and Water Supply. Courses also cover general procedure for the handling of fires in principal occupancies such as dwellings, apartments, cellars, factories, theatres, motion picture studios, ships, docks and warehouses. Outside lecturers are frequently made available from the faculties of the University of California, the California Institute of Technology and other universities. Specialists from the Police and Law Departments are also frequently called in. One of these was, for example, the judge of the Superior Court, who gave a lecture on "The Preparation of Evidence in Arson Cases." The Fire College was developed under the direction of Assistant Chief S. H. Dodd, who, on his retirement this month, has been succeeded by Battalion Chief Joseph L. Gowell. There are also three captains who serve as instructors, one of whom is in charge of drill work at the tower.

The college occupies an entire floor of the large headquarters building, and the classrooms, large lecture hall and demonstration equipment give it the atmosphere of a regular engineering school. Practical instruction regarding sprinkler systems, refrigeration plants, fire alarm and fire extinguishing

appliances can be given on complete operating units. Models of warehouses and skyscrapers are used to demonstrate the principles of ventilation in fires, use and penetration of fire streams and the like.

An excellent library of fire literature has been assembled as well as one of the most extensive files of photographs on fire protection subjects in existence. Considerable material in motion picture form is also available.

The college's influence outside Los Angeles has been extensive, as in addition to having made their courses available to men from many other cities, Assistant Chief Dodd and his staff of assistants have appeared before meetings of the Pacific Coast Association of Fire Chiefs, the International Association of Fire Chiefs, the annual fire schools of several western states, and before fire department groups in numerous Pacific Coast cities.

Bureau of Fire Investigation.

As effective fire prevention work must be based on an intelligent use of the lessons of previous fires, the work of the Bureau of Fire Investigation is considered of major importance in Los Angeles. Organized primarily as an "arson squad" to provide machinery to follow up incendiary fires, the bureau's activities are actually much broader. Investigators regularly respond to all fires in the high-value district and are on call 24 hours of the day to fires elsewhere in the city.

Reports are made on all fires with a loss of $100 or over, all cases wherein persons sustain burns, all explosions and false alarms. A special investigation is given to all fires reported as unknown or as due to a cause which is admittedly merely the best guess of the reporting officer.

Captain Paul Wolff is in charge of this bureau and has three regular assistants and two stenographers. Associated with the work of the bureau is a special agent of the National Board of Fire Underwriters and a police lieutenant of detectives. Seven detailed members of the Fire Department serve as investigators, making a total personnel of fifteen. In addition, one of the most experienced members of the District Attorney's force has been assigned to assist the bureau not only in the prosecution of cases, but also in their preparation.

All captains in the department are required to put in at least two weeks of intensive work with the bureau as a part of their training, to improve their understanding of the fire reports and to acquaint them with what constitutes evidence in arson cases and what must be done to preserve it.

Last year 11,896 persons were interviewed by the bureau in connection with the investigation of 1,462 fires and 202 cases where burns had been received. One hundred thirty-nine fires were determined to be incendiary or suspicious in their origin, 41 arrests were made and 25 convicitions obtained.

The bureau reports an important contribution to the science of identifying substances used to start fires. Chemical analysis is often unsuccessful, as

such substances as volatile oils change their forms and almost disappear after charring or burning takes place. The bureau has made extensive use of the microscopic enlargement of photographs and the microscopic study of specimens, and believes that it can now practically always tell just what was used in starting fires when specimens are available. In this work the Fire Department's photographic experts have played an important part by perfecting a new method of photographing surfaces which had never previously been photographed with any degree of success.

This line of investigation is reported as less difficult than might be supposed, as it is seldom that some person cannot be found who can state in what part of the building the fire originated. The careful examination of débris from that section by the microscopic and photographic methods makes it possible to determine whether some flammable material such as gasoline, fuel oil, benzine, naphtha, alcohol or other similar material was used. While it may take some time for this work to be recognized by the courts, it appears to be a decided advance.

Bureau of Fire Prevention.

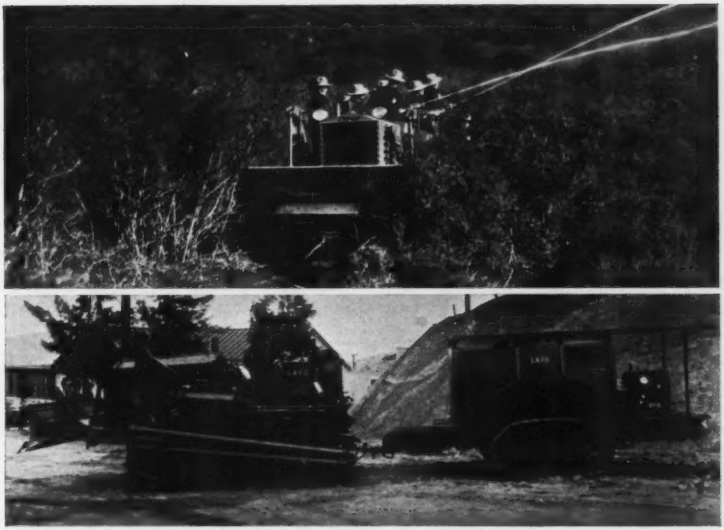
The Bureau of Fire Prevention is charged with the enforcement of laws to control fire hazards and the general inspection work of the department. The bureau is under the direction of Battalion Chief Victor E. Pierret and has a total personnel of 41, sufficient to make inspections of the entire city about once every 60 days. In addition to the chief, there is a permanent staff of three captains and three clerks. The inspection force is made up of 33 detailed members of the Fire Department.

Firemen, on being assigned to the bureau, are given special instruction by the more experienced inspectors. Men who have accumulated special experience in inspection work in certain occupancies and are particularly experienced in the control of certain hazards are given special assignments. At present certain inspectors are assigned to supervise hospitals and institutions, theatres, garages, filling stations, tank trucks, and cleaning and dyeing establishments. The other inspectors are given districts in which they are held responsible for conditions.

Bureau of Public Relations.

The department has a Bureau of Public Relations which was established, as its name implies, to take care of many of the contacts of the Fire Department with the public. Since it is through this bureau that the campaigns and other activities of the Fire Department looking to the reduction of fire hazards through educational programs are carried out, it is a most important division of the Los Angeles fire service. It is in charge of Captain Jere P. Kline, who has four assistants.

During the last year the bureau made 118 surveys of large manufacturing plants, motion picture studios, stores and warehouses, checking up on the



International and Los Angeles Fire Department Photos.

This mountain climbing fire apparatus was developed by the Los Angeles Fire Department to deal with forest fires in the mountain areas within the city limits. It is used to quickly plow fire-breaks and emergency roads in brush and also to haul a 1000-gallon water tank booster pump to otherwise inaccessible mountain locations. It is shown in action above; the complete unit is illustrated below.

fire hazards and fire protection, and discussing with the owners suggestions for the removal of hazards or improvement in protection. Many fire extinguishers, water buckets, standpipe and hose systems, and automatic sprinkler systems have been installed as a result of the bureau's work. Fire brigades are frequently organized and employees are given instruction in what the Fire Department expects them to do in case of fire.

One of the important functions of the bureau is to survey public schools and organize and conduct fire drills. This service makes for the maintenance of safe conditions and for the progressive elimination of the existing fire hazards in the schools.

A wide variety of educational activities are carried on, the bureau cooperating with the Junior Chamber of Commerce in its annual clean-up week and fire prevention campaigns, with various other civic organizations, and by delivering lectures on fire prevention before public and private schools, churches, service clubs and Boy Scout troops. In addition, radio addresses are given once or twice a week over local radio stations. The bureau has prepared considerable printed matter, pamphlets and posters, which are distributed during Fire Prevention Week and at other times during the year.

One member of the bureau has been devoting practically all his time to

the grass and rubbish fire hazard in outlying districts. This is one of Los Angeles' major problems and much has been done through the removal of rubbish and dried grass, the installation of incinerators and the supervision of brush and rubbish burning. This educational work has been so valuable that in some districts alarms of fire from this cause have been practically eliminated.

It is possible in an article of this kind only to touch on a few of the many activities of a large city organization such as the Los Angeles Fire Department. Only those of its functions which are of particular importance from the fire prevention viewpoint have been covered. Were space available the program of welfare work during the present period of distress which the Fire Department has undertaken in addition to its regular duties might be described. This has included the listing of needy citizens and the collection and distribution of supplies. To the maintenance of this work the Fire Department personnel contributed generously, both in money and time of its members. This typifies the spirit with which the Los Angeles Fire Department is serving its city in addition to giving an advanced grade of strictly fire service.

The 1931 Fire Loss.

Fire losses for the United States for the year 1931 are estimated by the National Board of Fire Underwriters at $464,633,265. This figure, determined since the publication of the April QUARTERLY, is approximately 3% greater than the preliminary estimate which appeared in that issue (see QUARTERLY, April 1932, page 342). This loss figure is based upon returns made by the insurance companies reporting to the Actuarial Bureau, adding twenty-five per cent for uninsured and unreported losses.

The 1931 fire loss is slightly more than $37,000,000, or 7.44%, below the total loss for 1930 and is approximately the same as for the year 1928. The values involved, however, have radically changed due to lower commodity prices, decreased inventories and deflated real estate values, so that the loss for 1931 while lower in actual dollars and cents may at the same time represent a material increase in the destruction of capital wealth.

The following tables indicate the annual fire loss in the United States for fifty-seven years and a comparison of losses on a per capita basis for the past ten years. In addition, there have been included tables showing the per capita losses of all cities of 100,000 population or over for a four-year period, and a table listing all cities of over 20,000 population where the per capita loss exceeded five dollars during the past year. In this latter class are forty-seven cities, a reduction from a total of 64 in 1930. Of these, but seven have a population of 100,000 or more.

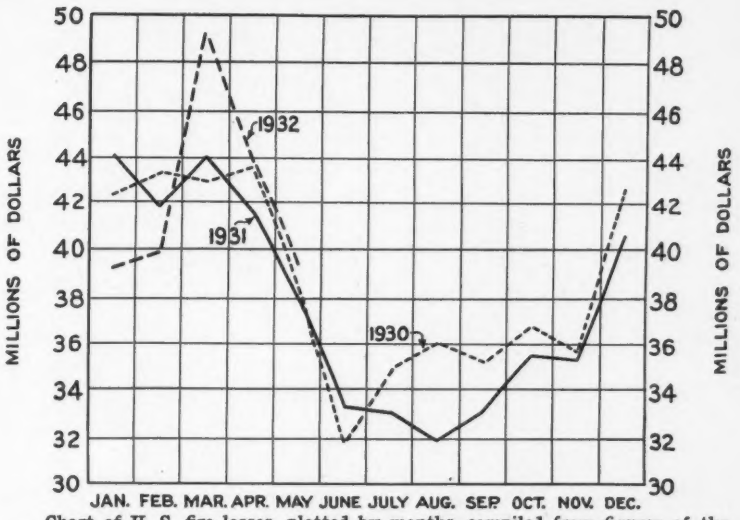


Chart of U. S. fire losses, plotted by months, compiled from figures of the National Board of Fire Underwriters.

For the most part the fire loss figures for cities are fire department estimates, and as such may be somewhat lower than those reported by the insurance companies. It is also to be noted that these figures may not, in all cases, be estimated on the same basis, and that they may in some cases be inconclusive if taken for a single city for a single year. This is particularly true in the case of the smaller cities, where a single large fire may materially distort the per capita figure. Nevertheless, the per capita fire losses are considered the best available index by which to compare the fire record of cities, and a high or low per capita fire loss continuing over a period of years is considered conclusive evidence of the true conditions.

The losses in cities of 20,000 population and over reported by the fire chiefs show a drop of 16.5% from 1930, which would seem to indicate that

Comparative U. S. Fire Losses.

	Whole Country			Cities of 20,000 Population and Over		
	Population	Total Loss	Per Capita	Population	Total Loss	Per Capita
1922.....	109,955,947	$506,541,001*	$4.62	33,821,476	$120,964,112†	$3.57
1923.....	110,663,502	535,372,782	4.84	42,946,639	147,102,119	3.42
1924.....	112,078,611	549,062,124	4.90	43,375,796	146,222,749	3.37
1925.....	115,378,094	559,418,184	4.85	45,297,469	160,011,951	3.53
1926.....	117,136,000	561,980,751	4.80	53,243,778	178,178,874	3.35
1927.....	119,320,000	472,933,969	3.96	51,291,549	144,618,641	2.82
1928.....	120,013,000	464,607,102	3.87	51,836,000	140,038,116	2.70
1929.....	120,700,000	459,445,778	3.81	53,411,000	145,059,043	2.72
1930.....	122,775,046	501,980,624	4.09	50,206,000	150,981,223	3.01
1931.....	124,070,000	464,633,265	3.74	51,084,000	125,933,681	2.47

*Estimated from Records of the Actuarial Bureau. †Figures reported by fire departments.

the high level of destruction is shifting from the large urban centers to the smaller communities. This inference is further substantiated by the record of the twelve cities whose population is in excess of the half million mark. Their losses comprised but 37% of the total loss for the country, but accounted for 58% of the reduction from the 1931 total.

Annual Fire Losses in the United States for Fifty-seven Years.

Year	Property Loss	Year	Property Loss	Year	Property Loss
1875.....	$78,102,285	1894.....	$140,006,484	1913.....	$203,763,550
1876.....	64,630,600	1895.....	142,110,233	1914.....	221,439,350
1877.....	68,265,800	1896.....	118,737,420	1915.....	172,033,200
1878.....	64,315,900	1897.....	116,354,575	1916.....	258,377,952
1879.....	77,703,700	1898.....	130,593,905	1917.....	289,535,050
1880.....	74,643,400	1899.....	153,597,830	1918.....	353,878,876
1881.....	81,280,900	1900.....	160,929,805	1919.....	320,540,399
1882.....	84,505,024	1901.....	165,817,810	1920.....	447,886,677
1883.....	100,149,228	1902.....	161,078,040	1921.....	495,406,012
1884.....	110,008,611	1903.....	145,302,155	1922.....	506,541,001
1885.....	102,818,796	1904.....	229,198,050	1923.....	535,372,782
1886.....	104,924,750	1905.....	165,221,650	1924.....	549,062,124
1887.....	120,283,055	1906.....	518,611,800	1925.....	559,418,184
1888.....	110,885,665	1907.....	215,084,709	1926.....	561,980,751
1889.....	123,046,833	1908.....	217,885,850	1927.....	472,933,969
1890.....	108,993,792	1909.....	188,705,150	1928.....	464,607,102
1891.....	143,764,967	1910.....	214,003,300	1929.....	459,445,778
1892.....	151,516,098	1911.....	217,004,575	1930.....	501,980,624
1893.....	167,544,370	1912.....	206,438,900	1931.....	464,633,265

NOTE:—Previous to 1916 figures obtained from the records of the New York *Journal of Commerce*, deducting the Canadian losses. Subsequent years are based on returns to Actuarial Bureau of the National Board of Fire Underwriters, adding 25% for unreported and uninsured losses. The figure for 1931 is based on estimates made by the Actuarial Bureau.

Per Capita Fire Losses of Cities Over 500,000 Population.

	Population	1928	1929	1930	1931	Four-year Average
New York, N. Y.....	7,090,000	$3.19	$3.54	$3.47	$3.24	$3.36*
Chicago, Ill.....	3,475,000	3.85	4.75	4.48	2.73	3.95
Philadelphia, Pa.....	1,950,000	2.73	2.86	2.72	2.12	2.61
Detroit, Mich.....	1,569,000	2.34	2.64	2.74	2.30	2.50
Los Angeles, Cal.....	1,238,000	2.12	2.98	1.27	1.82	2.04
Cleveland, O.....	911,000	3.22	3.42	4.26	2.61	3.38
St. Louis, Mo.....	824,000	3.34	2.41	2.58	1.77	2.52
Baltimore, Md.....	813,000	1.89	1.87	2.84	1.53	2.03
Boston, Mass.....	805,000	4.98	5.30	6.54	5.14	5.49
Pittsburgh, Pa.....	676,000	1.70	2.18	1.69	1.61	1.79
San Francisco, Cal.†...	647,000	...	...	...	...	...
Milwaukee, Wis.....	583,000	2.86	2.39	2.83	1.60	2.42
Buffalo, N. Y.....	573,000	3.34	4.47	2.00	2.20**	3.00

†Does not report its losses.

*These figures are based on losses paid in New York City by the subscribers to the Actuarial Bureau of the National Board. The fire department estimates for these years were considerably lower.

**Incomplete. Does not include Buffalo Armory fire, involving loss of at least $2,500,000.

Cities from 400,000 to 500,000 Population.

	Population	1928	1929	1930	1931	Four-year Average
Washington, D. C.....	488,000	$1.57	$2.37	$2.59	$ .75	$1.82
Minneapolis, Minn.....	474,000	3.75	2.71	3.25	3.06	3.19
New Orleans, La.....	471,000	1.77	1.54	1.57†	1.42	1.57
Cincinnati, O.....	452,000	2.60	2.04	1.74	1.89	2.06
Newark, N. J.....	444,000	3.57	3.01	3.62	2.82	3.25
Kansas City, Mo.....	409,000	4.59	3.84	3.69	2.71	3.71
Cities from 300,000 to 400,000 Population.						
Seattle, Wash.....	370,000	$ .99	$2.73	$2.14	$2.94	$2.20
Indianapolis, Ind.....	365,000	3.48	3.66	2.66	1.44	2.81
Rochester, N. Y.....	331,000	1.94	1.83	1.67	1.65	1.77
Jersey City, N. J.....	319,000	1.01	.54	2.26	1.14	1.24
Louisville, Ky.....	308,000	2.80	2.52	4.33	3.19	3.21
Portland, Ore.....	305,000	2.78	2.85	2.55	3.04	2.78
Houston, Tex.....	300,000	5.48	2.69	3.05	3.43	3.66
Cities from 200,000 to 300,000 Population.						
Columbus, O.....	291,000	$1.65	$1.22	$1.22	$ .40	$1.12
Toledo, O.....	290,000	2.56	3.61	2.98	3.70	3.21
Denver, Col.....	290,000	1.46	2.06	1.84	1.25	1.65
Oakland, Cal.....	285,000	1.50	1.58	2.65	2.83	2.14
St. Paul, Minn.....	272,000	1.98	3.39	3.68	2.70	2.69
Atlanta, Ga.....	270,000	3.23	2.69	6.73	2.48	3.78
Dallas, Tex.....	262,000	5.74	5.62	6.66	5.59	5.91
Birmingham, Ala.....	259,000	2.38	3.26	2.11	3.09	2.71
Memphis, Tenn.....	259,000	2.52	3.08	5.54	4.03	3.79
Providence, R. I.....	253,000	3.23	3.74	2.86	3.63	3.37
Akron, O.....	250,000	1.24	2.26	1.64	1.18	1.58
San Antonio, Tex.....	232,000	1.39	.68	.94	1.05	1.01
Omaha, Neb.....	216,000	2.14	5.42	2.07	2.56	3.05
Syracuse, N .Y.....	210,000	1.19	1.58	2.39	2.50	1.91
Dayton, O.....	202,000	2.41	1.04	1.07	1.07	1.39
Cities from 150,000 to 200,000 Population.						
Worcester, Mass.....	197,000	$4.47	$5.38	$3.69	$5.14	$4.67
Oklahoma City, Okla...	185,000	1.64	3.56	3.12	1.15	2.37
Richmond, Va.....	184,000	.66	2.01	.83	1.24	1.18
Youngstown, O.....	170,000	2.81	2.18	3.05	1.64	2.42
Grand Rapids, Mich....	170,000	2.07	1.11	1.00	2.05	1.56
Fort Worth, Tex.....	170,000	3.91	9.64	5.58	6.55	6.42
Hartford, Conn.....	164,000	1.71	2.35	3.12	1.87	2.26
New Haven, Conn.....	163,000	5.05	3.29	2.78	2.47	3.40
Flint, Mich.....	157,000	2.22	1.46	2.25	.89	1.70
Nashville, Tenn.....	156,000	8.89	8.11	5.89	4.55	6.86
San Diego, Cal.....	155,000	.82	.60	1.13	.57	.78
Springfield, Mass.....	150,000	2.41	2.17	2.15	3.20	2.48

†The New Orleans per capita loss figure for 1930 obviously does not include the two wharf fires which occurred during March, 1930, with a total loss of approximately $4,000,000.

Cities from 125,000 to 150,000 Population.

	Population	1928	1929	1930	1931	Four-year Average
Bridgeport, Conn.	147,000	$ .35	$ .87	$ .74	$1.05	$ .75
Scranton, Pa.	144,000	3.37	3.66	2.71	2.10	2.96
Des Moines, Ia.	143,000	3.50	5.56	5.03	1.50	3.89
Long Beach, Cal.	143,000	1.83	.72	1.19	1.11	1.21
Tulsa, Okla.	142,000	1.96	.92	1.24	.87	1.25
Salt Lake City, Utah	140,000	3.16	1.64	2.90	3.07	2.69
Paterson, N. J.	138,000	5.46	4.83	8.99	3.50	5.69
Yonkers, N. Y.	136,000	1.73	2.26	1.78	2.18	1.99
Jacksonville, Fla.	133,000	2.82	1.57	3.23	8.64	4.06
Norfolk, Va.	130,000	2.50	3.17	3.11	9.09	4.47
Albany, N. Y.	128,000	3.76	3.20	2.56	4.24	3.44

Cities from 100,000 to 125,000 Population.

Trenton, N. J.	124,000	$3.92	$2.36	$1.77	$2.70	$2.69
Kansas City, Kans.	123,000	1.52	1.47	1.00	.86	1.21
Chattanooga, Tenn.	120,000	2.53	2.21	8.57	2.91	4.05
Miami, Fla.	119,000	3.46	1.21	.94	1.20	1.70
Camden, N. J.†	117,000	...	...	...	...	...
Erie, Pa.	117,000	.58	.70	1.08	1.78	1.03
Elizabeth, N. J.	117,000	1.84	3.73	2.79	1.83	2.55
Spokane, Wash.	115,000	2.43	6.71	2.32	2.55	3.50
Fall River, Mass.	115,000	23.70	1.37	1.60	1.69	7.09
Fort Wayne, Ind.	115,000	.92	2.31	2.16	1.56	1.74
Cambridge, Mass.	114,000	4.34	3.61	7.57	4.14	4.91
New Bedford, Mass.	112,000	2.32	1.16	1.77	1.50	1.69
Reading, Pa.	112,000	8.43	4.65	2.58	3.67	4.83
Wichita, Kans.	111,000	4.31	2.55	.68	.76	2.07
Tacoma, Wash.	108,000	6.13	2.19	6.09	2.93	4.33
Wilmington, Del.	107,000	.77	1.59	.89	2.35	1.40
Knoxville, Tenn.	106,000	1.83	1.34	3.57	1.29	2.01
Canton, O.	106,000	.91	1.96	2.59	1.12	1.64
Peoria, Ill.	105,000	3.18	3.58	2.50	2.34	2.90
South Bend, Ind.	105,000	1.59	2.95	1.81	.91	1.81
Gary, Ind.	105,000	1.30	2.22	3.66	2.64	2.45
Somerville, Mass.	104,000	2.51	2.25	3.86	2.81	2.86
Evansville, Ind.	104,000	4.49	1.57	5.68	1.76	3.37
Utica, N. Y.	104,000	3.02	4.16	4.86	6.59	4.66
El Paso, Tex.	103,000	1.39	3.49	1.18	3.76	2.45
Lynn, Mass.	102,000	4.93	3.94	3.89	4.52	4.32
Duluth, Minn.	102,000	3.76	3.78	4.61	3.66	3.95
Tampa, Fla.	101,000	4.18	2.75	1.51	2.32	2.69
Lowell, Mass.	101,000	2.28	1.99	2.80	2.41	2.37
Waterbury, Conn.	100,000	2.95	2.59	1.78	2.15	2.37

†Does not report its losses.

Cities in Which Losses Exceeded $5.00 Per Capita in 1931.

La Grange, Ga.	$15.34	‡Passaic, N. J.	$6.82
†Aurora, Ill.	15.07	Steubenville, Ohio	6.73
*Winston-Salem, N. C.	13.49	*Ashland, Ky.	6.67
Olean, N. Y.	12.72	Utica, N. Y.	6.59
Alliance, Ohio	12.33	Middletown, N. Y.	6.59
‡Peabody, Mass.	12.26	†Ft. Worth, Tex.	6.55
Enid, Okla.	9.99	High Point, N. C.	6.43
*Chelsea, Mass.	9.39	Eau Claire, Wis.	6.35
Galveston, Tex.	9.35	*Meridian, Miss.	6.24
Norfolk, Va.	9.09	†Waukegan, Ill.	6.19
*Plainfield, N. J.	9.07	Mobile, Ala.	6.13
*Cedar Rapids, Iowa	8.93	‡Elmira, N. Y.	5.82
*Hagerstown, Md.	8.92	†Wichita Falls, Tex.	5.80
Stockton, Calif.	8.88	*Springfield, Ill.	5.74
*Danville, Ill.	8.76	**Dallas, Tex.	5.59
Jacksonville, Fla.	8.64	*Portsmouth, Va.	5.54
**Atlantic City, N. J.	8.50	†Gadsden, Ala.	5.32
*Rome, Ga.	8.23	*Wilmington, N. C.	5.29
Melrose, Mass.	7.99	*Oshkosh, Wis.	5.19
†Gloucester, Mass.	7.45	†Boston, Mass.	5.14
*Nashua, N. H.	7.43	*Worcester, Mass.	5.14
Auburn, N. Y.	7.43	Berlin, N. H.	5.11
Brookline, Mass.	7.05	†Waco, Tex.	5.01
†Revere, Mass.	7.03		

*In this class in two of the last five years.
†In this class three of the last five years.
‡In this class four of the last five years.
**In this class five consecutive years.

Losses Slightly Higher for First Part of 1932.

The fire losses for the United States for the first five months of 1932 were $211,331,286, which is $2,131,417, or approximately 1.0%, more than for the same period last year, according to estimates prepared by the National Board of Fire Underwriters.

	1929	1930	1931	1932
January	$44,713,825	$42,344,035	$44,090,449	$39,224,783
February	41,520,290	43,206,940	41,776,051	39,824,622
March	41,277,814	42,964,392	44,074,362	49,189,124
April	36,845,795	43,550,996	41,423,764	43,822,233
May	32,129,408	38,415,142	37,835,273	39,270,524
Total—5 Months	$196,487,132	$210,481,505	$209,199,869	$211,331,286

Canadian Fire Losses, 1931.

The total Canadian fire loss for 1931 was $47,117,334, sustained in approximately 50,000 fires. This loss exceeds the loss for 1930 by almost exactly one million dollars, but if the loss incurred in the harbor conflagration at West St. John, N. B., amounting to nearly $3,000,000, is deducted the loss for the year 1931 is substantially less than for the previous year, notwithstanding an increase of 25% in the number of fires reported.

The West St. John waterfront conflagration was the first Canadian loss amounting to more than $1,000,000 in a number of years. Fires in which the individual loss exceeded $100,000 were twenty-nine as compared with forty-one in 1930. Among the larger losses were the following, involving individual losses in excess of $250,000.

West St. John, N. B.	Harbor Properties	$2,741,881
Ottawa, Ont.	St. Jean Baptiste Church	484,150
Nipissing, Ont.	Lumber yard and mill	406,422
Montreal, P. Q.	Western Canada Flour Mill	385,000
Falconwood, P. E. I.	Insane asylum	350,000
Montreal, P. Q.	St. Denis Church	325,000

The loss of life by fire during the year was 251 as compared with 311 in 1930. Of these, 126 were children of immature age, 71 being burned in their homes during the absence of parents or other responsible persons.

The following tables, compiled from statistics furnished by the Dominion Fire Prevention Association, give a picture of the fire waste problem in Canada for the past few years.

A Decade of Fire Losses in Canada.

Year	Property Loss	Per Capita	Year	Property Loss	Per Capita
1922	$54,390,000	$6.11	1927	$32,254,084	$3.29
1923	48,282,000	5.36	1928	36,402,018	3.79
1924	45,906,500	4.99	1929	47,499,746	4.85
1925	40,729,724	4.35	1930	46,109,875	4.70
1926	38,295,096	4.15	1931	47,117,334	4.54

Municipal Group Classification, 1930-1931.

	1930		1931	
	Total Loss	Per Capita	Total Loss	Per Capita
Cities over 10,000 population	$14,643,570	$3.43	$17,243,580	$4.00
Towns 5,000 to 10,000 population	1,963,095	3.92	2,301,813	3.98
Towns 1,000 to 5,000 population	3,891,724	5.13	3,094,417	4.07
Villages under 1,000 population	9,877,062	5.47	8,246,519	5.16
Rural districts	15,734,424	5.13	17,231,005	5.63
Total	$46,109,875	$4.70	$47,117,334	$4.54

Losses by Provinces.

	Population	Loss, 1930	Per Capita Loss, 1930	Loss, 1931	Per Capita Loss, 1931
Alberta	731,605	$2,963,191	$4.58	$2,982,579	$4.07
British Columbia	694,263	4,701,000	7.95	3,162,394	4.55
Manitoba	700,139	2,746,304	4.14	2,517,056	3.59
New Brunswick	408,219	1,942,885	4.63	4,222,349	10.34
Nova Scotia	512,846	1,614,393	2.48	1,735,317	3.38
Ontario	3,431,683	16,145,531	4.93	15,959,308	4.65
Prince Edward Island	88,038	235,944	2.74	821,290	9.32
Quebec	2,874,255	12,176,675	4.51	12,085,135	4.20
Saskatchewan	921,785	3,504,293	4.04	3,564,485	3.87
Not reported	.....	79,562	...	67,421	...
Total	10,374,196	$46,109,875	$4.70	$47,117,334	$4.54

Occupancy Group Classification, 1931.

Group	No. of Fires	Property Loss	Average Loss per Fire
Manufacturing plants	885	$7,221,806	$8,160
Mercantile establishments	5,145	10,468,598	2,035
Residential property	34,545	13,504,212	391
Farm property (other than dwellings)	3,240	5,418,227	1,672
Institutional buildings*	535	3,174,354	5,933
Miscellaneous property**	4,834	7,330,137	1,516
Total	49,284	$47,117,334	$956

*Institutional buildings include churches, colleges, schools, hospitals, convents and philanthropic institutions.

**Included in Miscellaneous is the St. John, N. B., harbor fire, involving a loss of $2,741,881.

Origin of Fires in Canada, 1931.

Causes Reported	No. of Fires	Causes Reported	No. of Fires
Smokers' carelessness	12,335	Spontaneous ignition	907
Stoves, furnaces and pipes	8,934	Portable lamps and lanterns	668
Sparks on roofs	2,771	Open fires	485
Electrical defects and appliances	2,626	Miscellaneous special hazards	374
Carelessness with matches	2,317	Supposed incendiary	298
Lightning	1,456	Fireworks	203
Exposure	1,391	Miscellaneous known causes	2,467
Defective chimneys and flues	952	Unknown causes	9,596
Volatile liquids	928		
Hot ashes and coals	576	Total	49,284

Fatalities by Fire, 1925-1931.

Year	Men	Women	Children	Total
1925	84	92	171	347
1926	79	86	123	288
1927	86	107	272	465
1928	51	84	179	314
1929	47	65	121	233
1930	53	91	167	326
1931	47	78	126	251
Total	457	593	1,159	2,209

Fire Losses — Great Britain and Ireland.

Statistics compiled by *Fire*, the official journal of the British Professional Fire Brigades Association and official record of the British National Fire Brigades Association, show a continuance in 1931 of the downward trend of fire losses started last year after the peak year of 1929.

Annual Fire Losses—Great Britain and Ireland.

1922*	£9,395,880	1927†	£7,893,240
1923*	13,019,400	1928†	10,628,470
1924*	8,939,080	1929†	15,617,471
1925†	9,012,740	1930†	10,520,540
1926†	8,726,300	1931†	9,849,470

*Figures for 1922 to 1924 inclusive were taken from the London *Times*, with 20% added for small and unreported losses. †Figures for 1925 to 1931 inclusive were obtained from *Fire*.

Losses by Months—Great Britain and Ireland.

	1927	1928	1929	1930	1931
January	£413,000	£928,200	£1,479,300	£1,213,800	£764,500
February	581,000	435,400	1,090,280	965,000	712,300
March	431,900	540,680	2,120,800	1,010,100	1,391,600
April	759,500	693,100	1,512,700	758,800	470,120
May	507,745	1,310,400	1,661,800	466,200	471,100
June	676,900	508,340	1,322,900	543,200	751,800
July	780,500	1,040,200	1,366,400	625,500	389,900
August	604,800	1,104,500	1,561,000	608,300	709,800
September	635,600	1,039,500	982,100	1,883,840	965,300
October	325,940	1,941,100	1,121,750	423,500	607,250
November	655,000	532,700	716,100	1,243,200	1,964,200
December	1,743,200	560,800	694,141	779,100	649,600
Total	£7,893,240	£10,628,470	£15,617,471	£10,520,540	£9,849,470

Comparative National Fire Losses.

The losses of Great Britain and Ireland, Canada, and the United States for a ten-year period are given below in parallel columns. For comparison the losses of Great Britain and Ireland have been reduced to dollars.

	Great Britain and Ireland		Canada		United States	
	Total Loss	Per Capita	Total Loss	Per Capita	Total Loss	Per Capita
1922	$46,100,000	$1.04	$54,391,000	$6.11	$506,541,000	$4.62
1923	63,250,000	1.43	48,282,000	5.36	535,373,000	4.84
1924	43,400,000	.97	45,907,000	4.99	549,062,000	4.90
1925	43,800,000	.99	40,730,000	4.35	559,419,000	4.85
1926	42,410,000	.96	38,295,000	4.15	561,980,000	4.80
1927	38,361,000	.87	32,254,000	3.29	472,933,000	3.96
1928	51,654,000	1.17	36,402,000	3.79	464,607,000	3.87
1929	75,901,000	1.72	47,499,700	4.83	459,446,000	3.81
1930	51,125,428	1.27	46,109,900	4.70	499,739,000	4.09
1931*	47,932,245	1.04	47,117,334	4.54	464,633,265	3.74

*Figured on normal exchange ratio of 4.8665 in order to continue the comparison on same basis as other years.

Discovery and Removal of Pipe Obstructions.

By A. L. Brown (Member N.F.P.A.),
Factory Mutual Laboratories.

About three years ago a fire started in a tower adjoining a two-story silk mill in West Virginia. The building, although outside the town and beyond public water and hydrant protection, was sprinklered and had its own water supply from an elevated tank.

When a watchman discovered the fire, the first story of the tower was all ablaze. The public fire department was called, but by the time they had stationed a pumper at a small stream about 1000 ft. away and laid one hose line the fire had burned through the two wooden floors in the tower and had entered both stories and the basement of the main mill. The automatic sprinklers prevented the spread of fire in the basement, and there was little fire in the first story because the first and second floors were of concrete and there was very little combustible material near the tower. In the top story the main roof, which was of wood, was ignited and considerably burned over five bays before the fire was stopped by the fire department. All of the 200 sprinkler heads in this area fused. There was no evidence of water in either the first or second story of the main building or tower.

During the fire the roof and both floors in the tower fell and broke a fitting in the main sprinkler piping. Before any investigation was made of the lack of water, a plumber repairing the sprinkler system discovered a blank metal gasket at a flange in the 6-in. main riser. The photograph, Fig. 1, shows this blank gasket, which is of a type sometimes used to permit testing or placing part of a system in service, before all of the piping is completed. No work had been done on the sprinkler system since it was installed ten years previously.

Tests had been made regularly at a valve provided at the top of the elevator tower sprinkler piping, but this was fed from the sprinkler piping in the basement. There was no test valve on the system in the first and second stories of the main building.

This was one of the unfortunate cases where the trouble was not discovered until after the fire. The building was essentially unsprinklered and the large investment in protection was wasted. In fact it was worse than wasted, due to the false sense of security which it gave. The probability of recurrences has been reduced by the adoption of new designs of blank gaskets which will be conspicuous when in service and which in most cases must be accounted for by sprinkler workmen as are tools and other important items of equipment.

Address before the thirty-sixth annual meeting of the N.F.P.A., May 11, 1932. (See Proceedings, page 117.)

Fig. 1. Two views of blank gasket found in pipe supplying sprinklers, after fire in West Virginia silk mill.

The foregoing case was a good example of one serious type of obstruction which resulted wholly from carelessness and was without evident symptoms. There are numerous other kinds of pipe obstructions and more desirable methods of discovery.

Trouble is often caused by deposits of mud, sand and rust which gradually accumulate in sprinkler piping. Scale and rust alone are found most frequently in dry pipe equipments and in open sprinkler systems. The heads most likely to be affected are those near the ends of feed mains. Little trouble from this source is to be expected in wet systems or in dry pipe systems which are kept dry at all times. The condition of the piping can be learned only by making flow tests from the branch lines or by removing sections of piping for examination.

Investigation of pipe conditions can sometimes be combined with operating tests of dry pipe valves by opening mechanically an automatic sprinkler head on a platform or at some other safe location.

Mud, sand, gravel, sawdust and other fine materials have clogged fire protection systems seriously. Trouble can be expected where the water supply contains these materials, especially if there is circulation or a flow of water through parts of the system, or if the system has been drained and refilled a number of times. In some localities private water supplies taken from rivers or ponds contain a surprising amount of suspended material, especially in the spring or after heavy rains. Water from driven wells or from improperly operated sand filters sometimes contains sand.

Sediment in large mains is usually evident during flow tests from hydrants or pumps. If seen here, or if its presence is suspected, a careful investigation of sprinkler piping should be made.

Soft materials can usually be removed from fire systems by thorough flushing. The first step is to take large flows from the yard piping through hydrants or blow-offs at dead ends. Next, the connections between mains and risers are flushed by opening the drain valves. Following this, the trunk mains of the sprinkler system should be flushed through fire hose attached to connections provided for the purpose near the ends of the mains. Finally, branch lines should be washed out through smaller hose attached at the end fittings. Pendent heads should be examined carefully. These and branch lines fed

from the bottom of the trunk mains are particularly susceptible to clogging and should be eliminated where possible to do so.

Careless work in laying street mains or yard piping often allows stones and dirt to enter the piping. This condition can seldom be anticipated. Often, however, it can be detected by making careful flow tests through new work. The streams should be passed through burlap bags or other straining devices to retain small stones and gravel otherwise carried away by the streams without being detected.

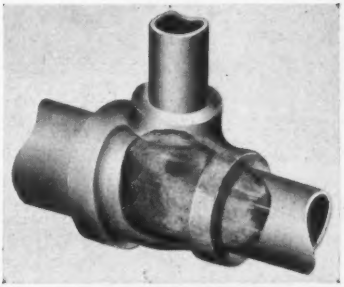


Fig. 2. Piece of brick found in a fitting in a sprinkler system after a serious fire.

The photograph in Fig. 2 shows a piece of brick found at a fitting in sprinkler system after a serious fire had occurred. The trouble started at a conveyor passing through a large unprotected opening between two important areas. Fire spread rapidly due to the presence of some wood dust, and workmen reported that with one whole bay ablaze no water was coming from the sprinklers in the vicinity. The heat from the fire in the unprotected area quickly opened most of the 300 sprinklers in the building and depleted the supply so that the heads in the top story had no water. The building was practically destroyed.

After the fire the yard piping was flushed, the indicator post valves dug up, and the dry pipe valves examined. Everything appeared in good order. The sprinkler piping at the area where the fire started, was salvaged and reassembled and water admitted. Thirty-six of the sprinklers discharged no water, and when the piping was taken apart a half brick was found inside of a tee.

It is largely good fortune if an obstruction of this type, already lodged in branch piping, is discovered before a fire. Prevention consists of careful work in flushing buried piping through hydrants, draw-offs and other large openings before water is turned into the smaller piping. Occasionally stones have been heard passing along the pipe when dry valves were tripped during test and have been located and removed.

The variety of objects found in fire systems due to carelessness, or lack of memory while pipe was being laid, is surprising. Leather gloves, coils of rope, and tools are typical. Lead from badly made joints is a frequent offender.

In another case an obstruction was located and removed from a new equipment before a fire had opportunity to occur.

When an inspector opened a 2-in. riser drain, it was observed that the pressure fell quite rapidly and reached zero with less than enough water to supply a single sprinkler still flowing. The indicator post gate was operated and appeared to work properly. Next the indicator gate was closed and an elbow at the bottom of the riser was removed without disclosing any obstruction. The piping contractor and the water department employees who made the service connection were then interviewed, and it was learned that an additional service valve had been installed in the supply line and then buried without a valve box. This valve was uncovered and it in turn appeared to

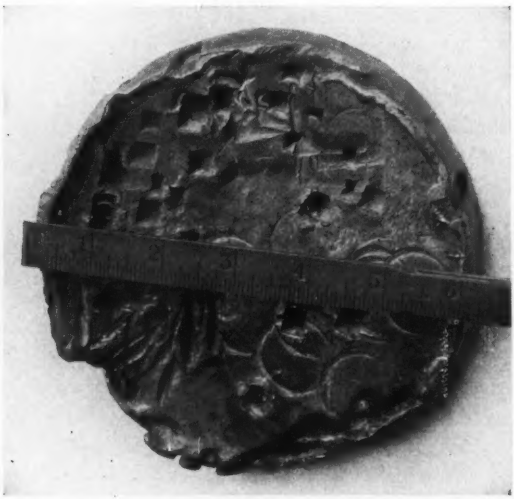


Fig. 3. Lead disc obstructing supply, found as a result of test of sprinkler system. Joint in underground pipe had not been properly caulked before pouring lead.

operate properly. It was then decided to observe the movement of the gates in the indicator post. The service valve was closed and the elbow at the riser again removed. Fortunately, the distance from the open pipe at the elbow to the indicator post gate was short, and with the aid of a flashlight it could be seen that there was no movement at the gate when the indicator post was turned. The indicator post gate was then removed and a lead disc about one inch thick and weighing almost 12 lbs. was found across the waterway. This is shown by the photograph in Fig. 3. The answer is as follows: when the pipe was laid, a short section of 6-in. cast iron pipe came next to the indicator post gate. To reduce work in the trench, the valve, with the gate closed, was placed on the ground and the short length of pipe was set upright in the bell.

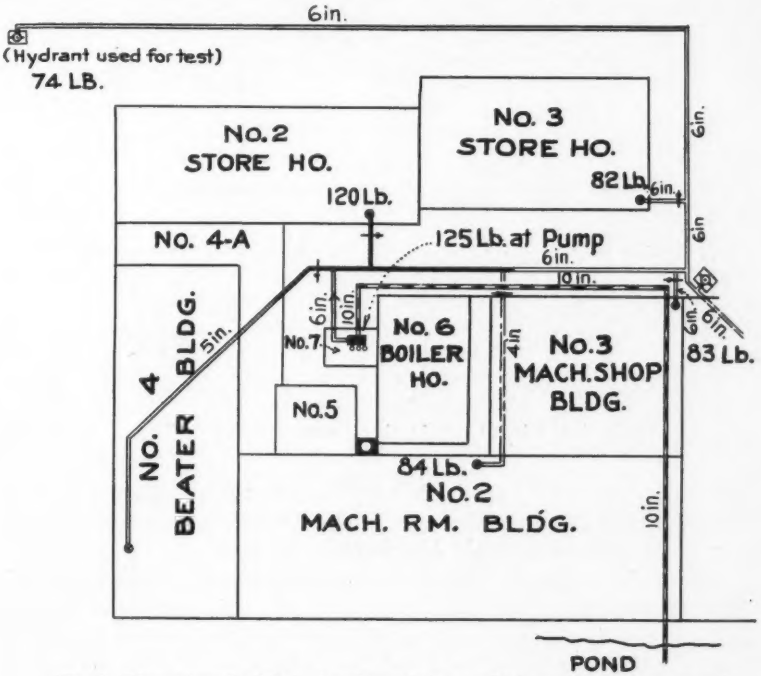


Fig. 4. Plan of yard piping, showing points at which readings were taken in locating obstruction.

The joint was yarned poorly and when the lead was poured about twelve pounds ran through and solidified across the waterway above the closed gate.

The method usually used, and often the only one applicable in locating obstructions in underground piping, will be illustrated by another actual occurrence.

Annual tests of a fire pump indicated a poor delivery through the yard system. The pump when tested alone from its hose connections gave satisfactory results. The arrangement of the yard piping is shown by Fig. 4. The public water supply was shut off and a $1\frac{3}{4}$-in. stream with one length of hose was taken from the hydrant at the dead end of the system. The flow was measured accurately by pitot tube and checked with the value given by hydrant and hose streams tables. Pressure gauge readings were taken at all accessible points along the main between the pump and the hydrant. The four sprinkler risers in the buildings afforded convenient locations. The pressure readings, corrected for differences in elevation, are indicated on the sketch. Plotting these pressures against the length of main as shown by Fig. 5 indi-

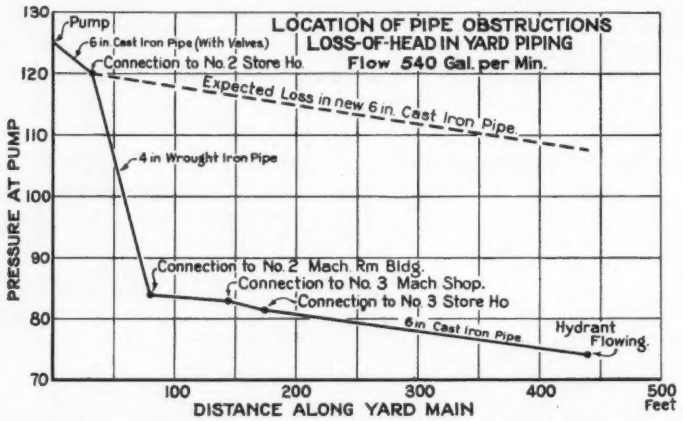


Fig. 5. Chart of friction loss in piping system shown in Fig. 4. Excessive drop indicates location of old wrought iron pipe.

cated clearly where the excessive loss in pressure occurred. Digging down to the pipe, it was found that instead of 6-in. cast iron pipe as was expected, there was a section of very old 4-in. wrought iron pipe.

Fixed obstructions, whether local large objects such as those mentioned, partly closed valves, or hard deposits which cause a reduction in effective pipe sizes, can only be detected and located by accurate measurements of loss in head with water flowing. Careful analysis is needed to determine whether the obstruction is local or is distributed uniformly along the line.

Local obstructions and partly closed valves are difficult to detect unless large flows are taken. To show this, tests have been made by progressively closing a gate valve in a 6-in. supply line while water was being drawn from a wide open 2-in. drain valve. The pressure near the 2-in. connection did not fall off appreciably until the 6-in. valve was closed $9\frac{1}{2}$ turns out of a total of $12\frac{1}{2}$. This example is given, not to show that partial obstructions are unimportant, but rather to indicate that if they are to be detected and located accurately, relatively large water flows must be taken and pressure readings carefully made.

Special care is needed in investigating public mains or other long lines of pipe. If losses in head are to be found accurately, flows also must be known closely. In lines where there may be a demand for water in addition to the test flow, this must be considered and eliminated or determined at least approximately. Pipe lines having considerable differences in elevation may take in air at high points during heavy flows and give erratic or erroneous results.

Explosions in Sewage Disposal Plants.

By R. M. Cadman,
(Member N.F.P.A.).

Although the existence of an explosion hazard in sewage disposal plants has been recognized for some time, it was not until after the Woonsocket, R. I., disaster on October 2, 1931, that any serious consideration was given to the subject. The explosion at the Woonsocket sewage disposal plant, costing the lives of two workmen and causing considerable property damage, served to emphasize the fact that modern methods of sewage treatment and disposal are becoming continuously more hazardous and to indicate the need for proper and adequate safeguards.

A typical modern sewage disposal plant is arranged substantially as follows. The raw sewage enters the grid and screen chamber where, in some instances, it is prechlorinated. It passes through a coarse bar screen, which removes rags and large solids, and flows to settling basins which are provided with electrically driven agitators. The solid matter remaining settles to the bottom of these basins and the liquid flows to the chlorinating chambers and thence to some near-by stream.

The solids are then pumped from the bottom of the settling basins to the digestion tank, where they remain for bacterial action. The digestion tank, also provided with an electrically driven agitator, is covered and the gas that is given off (largely methane) is collected and used as fuel under gas-fired boilers for a hot water heating system. The hot water system heats the digestion tank and other buildings of the plant. By raising the temperature of the sludge in the digestion tank bacterial action is greatly accelerated. In some cases the sludge gas is also used as fuel for internal combustion engines. Sludge gas has a heating and power generating value about equal to that of natural gas.

After the sludge in the digestion tank has been sufficiently acted upon by bacteria, it is pumped to drying beds, where it remains until thoroughly dry. It is then removed and carted away for use as fertilizer. The liquid passes through the sand of the drying beds by gravity and is then pumped back to settling tanks, whence it is discharged into some near-by river or stream.

The digestion tank furnishes the chief source of explosions. Sludge gas, or methane, generated by the bacterial action in the tank, is a light odorless gas. When mixed with air in proportions ranging from approximately 6 to 12% it is highly explosive.

Comparatively little detailed information relative to explosions and fires in sewage disposal plants is available, but three typical fires will serve to indicate the potential hazard involved in sludge digestion tanks.

Ocean Grove, N. J., Explosion and Fire, April 25, 1915.

This explosion and fire occurred during the inspection of the sewage disposal plant by a group of municipal officials from another town and cost the life of one of the visitors and severely burned another.

The inspection party had been making a tour of several sewage disposal plants, and on arrival at Ocean Grove proceeded to inspect the plant without first getting in touch with the Superintendent of Sewers. A manhole cover was removed from the sludge digestion tank and two of the party had entered the tank and a third was entering when the first man to enter struck a match, probably to find his way about.

There was a flash followed by an explosion. The man just entering was blown through the manhole and burned. The second man to enter the tank succeeded in reaching the rim of the manhole, where he remained until dragged out. He was so severely burned that he died that night. The first man to enter the tank, whose act was responsible for the explosion, was thrown into the corner of the tank under the manhole and was severely burned. He was later carried out.

The tank itself was apparently undamaged. There must have been a considerable quantity of gas present for the tank had not been ventilated prior to the inspection.

Mount Ephraim, N. J., Explosion, October, 1930.

This explosion occurred at a sewage disposal plant late one afternoon after the operator in charge had left. Although very little information is available, it is believed that some inquisitive person removed a manhole cover from the sludge digestion tank and threw a lighted match inside. Three other covers were removed by the force of the explosion that ensued and a considerable amount of glass was broken. Apparently no one was injured although three men were reported to have been near the spot when the explosion occurred.

Woonsocket, R. I., Explosion, October 2, 1931.

An explosion occurring at 11:25 A.M. on October 2, 1931, in the sludge digestion tanks of the Woonsocket, R. I., sewage disposal plant, cost the lives of two workmen and resulted in considerable property damage. The plant involved was of the activiated sludge type and was completed and put into operation during the spring of 1931.

There were two sludge digestion tanks having three compartments each. These tanks were of the pressure type, provided with facilities for the collection and burning of the sludge gas. One of these tanks had been in use since the plant had been put into operation, a period of about five months. It was planned to use the other tank, and accordingly some of the sludge, already partly digested, had been transferred for seeding purposes. While the transfer

Water Works and Sewerage.

Woonsocket, R. I., sewage disposal plant looking toward end of sludge digestion tank, where explosion exerted greatest force. One man killed was in compartment at the right. The other was standing on the roof of the center compartment.

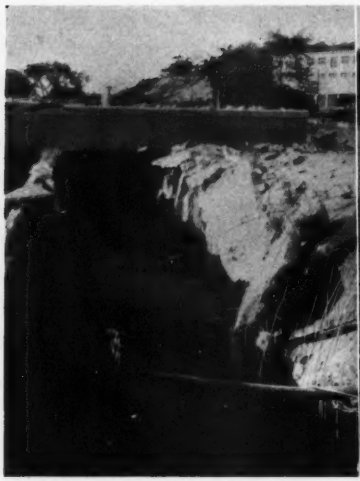
was being made the gas line to the boilers had been closed and no gas was being burned when the accident occurred. All vents to the tank had been opened to permit any accumulated gas to escape.

Just prior to the explosion two workmen had entered the tank which had been in use. This tank at the time contained partly digested sludge to the depth of about three feet, and all metal work in the tank was reported to have been wet. One of the workmen had just emerged from section No. 1 or No. 2 of the three-compartment tank, where he had inspected the conveyor mechanism. The other workman was still down in the third section, standing on a rung of the metal ladder, when the explosion occurred. From the appearance of the damage it seems evident that the explosion had its inception and was most violent in this section.

The first evidence of the explosion was a hissing flame followed by a powerful blast. The man in the tank was blown out through the manhole and into a near-by field, his clothing practically burned from his body. The other man was thrown upward with the roof of the tank and his body was later recovered from the sludge in the tank. Both were almost instantly killed. Two other workmen standing on the roof of the adjoining gas chamber were uninjured.

The cause of the explosion is not definitely known. The fact that the metal parts of the tank were wet, coupled with the fact that the man carried no tools and wore rubber soled shoes, would seem to eliminate a possible static or mechanical spark as the ignition agent. He carried no light and from this fact it may be deduced that he may have struck a match to facilitate his inspection.

The extent of the damage to the roof and walls of the digestion tank may be readily seen in the accompanying photographs.



Water Works and Sewerage.

View of center section of Woonsocket, R. I., digestion tank. Workmen standing on roof of gas chamber at back of this picture escaped injury.

Water Works and Sewerage.

Wall of sludge digestion tank at Woonsocket, R. I., showing portion of outer wall and damage thereto.

There is at least a theoretical possibility that explosions in sewage digestion tanks may be due to the ignition of an unusual gas that has the peculiar property of igniting spontaneously on contact with air. This theory would account for the occurrence of explosions just after manhole covers have been opened. Phosphine, a compound of hydrogen and phosphorus, a gas that has the property of spontaneous ignition on contact with air, is reported as occasionally generated in sewers, and might conceivably also be present in sewage tanks. There is also the theoretical possibility of the formation of chloride of nitrogen, likewise dangerous, where the sewage is chlorinated before entering the digestion tanks. These possibilities have not been scientifically investigated so far as is known.

Another hazard of sewers and sewage treatment plants, primarily from the standpoint of safety to life, is that of hydrogen sulphide gas. Within recent months it is reported that there have been a number of fatalities from the presence of this gas in connection with the operation of sewage systems. The latest of these was the asphyxiation of two sanitary engineers while working in a sludge sampling manhole at the sewage disposal plant in Lima, Ohio.

This gas is practically as deadly as hydrocyanic-acid gas, and when in high concentrations it is without odor. This characteristic has resulted in death, whereas its presence in lesser concentrations would have been detected

by its unmistakable odor which would have served as a warning. Hydrogen sulphide is combustible when mixed with air in proper proportions. There are, however, no definite records to indicate that explosions have been caused by the presence of this gas in sewers or sewage disposal plants.

Conclusions.

The foregoing furnishes ample evidence of the definite need for safe construction and proper safeguards for sewage disposal plants from a fire and explosion standpoint. In order to provide reasonable safety the following recommendations have been suggested by the National Board of Fire Underwriters.

All buildings in connection with sewage disposal plants should be of fire-resistive construction. Buildings should not be erected over sludge tanks.

Sludge digestion tanks, where gases accumulate, should be provided with a relief valve arranged so as to operate at a predetermined pressure. The vent from this relief valve should extend outside of building and at sufficient height to insure proper diffusion of gases.

Sludge tank agitator shafts should be provided with suitable stuffing boxes to prevent the escape of gases. Operating mechanism should be properly grounded.

When buildings are constructed over sludge tanks the following precautions should be taken.

(1) Only incandescent vaporproof globes in marine type fittings should be used. No spark emitting devices or open flames should be permitted within the building.

(2) Gas consuming devices shall be entirely cut off from the building, with entrance from the outside only.

(3) Buildings shall be provided with a suitable ventilating system for carrying off any dangerous gases.

(4) The walls of the buildings shall have ample window area, with thin glass or with wired glass sash hung so as to swing outward.

(5) The pores in concrete tops forming floors of building shall be thoroughly closed to prevent seepage of gas.

All chlorine except that actually being used should be stored in a detached non-combustible building, with door kept locked to prevent the entrance of unauthorized persons.

Portland, Oregon, Fire Alarm System.

By C. C. Ralph,
Acting Superintendent, Fire Alarm Telegraph.

One of the problems that arose when Chief Edward Grenfell (Member N.F.P.A.) took over the administration of the Portland Fire Department was the elimination of night watch in the various fire stations without impairment of the efficiency of the department and the promptness of response to alarms.

Our fire alarm system is the standard Class A system conforming to the regulations promulgated by the Committee on Signaling Systems of the N.F.P.A. This embraces primary and secondary alarm circuits to each fire station, with the customary punch registers and gongs, five fire stations in series on a circuit, box circuits looping into the stations for test purposes, and local alarm or tap-out gongs in all stations. We also comply with other features of the regulations as set forth.

After about four months of discussion by the executive staff of the department, a tentative plan was agreed upon as follows:

1. At 11:00 P.M. a signal should be sent over the primary alarm circuit to all stations, signifying the end of the day watch and the shift to the so-called silent system. All plug-out boards would be cleared at stations and the officer in charge would receive all alarms.

2. Alarms would be sent only to the stations answering them, except in the case of multiple alarms or when, in the judgment of the fire alarm operator, the whole department should be notified. In the latter instances the operator would tap out the entire department at once, giving the companies out and boxes that were in. The officer in charge of each station would detail a man to stand watch and the department would operate according to day schedule until the signal should be received that the silent system was again in effect.

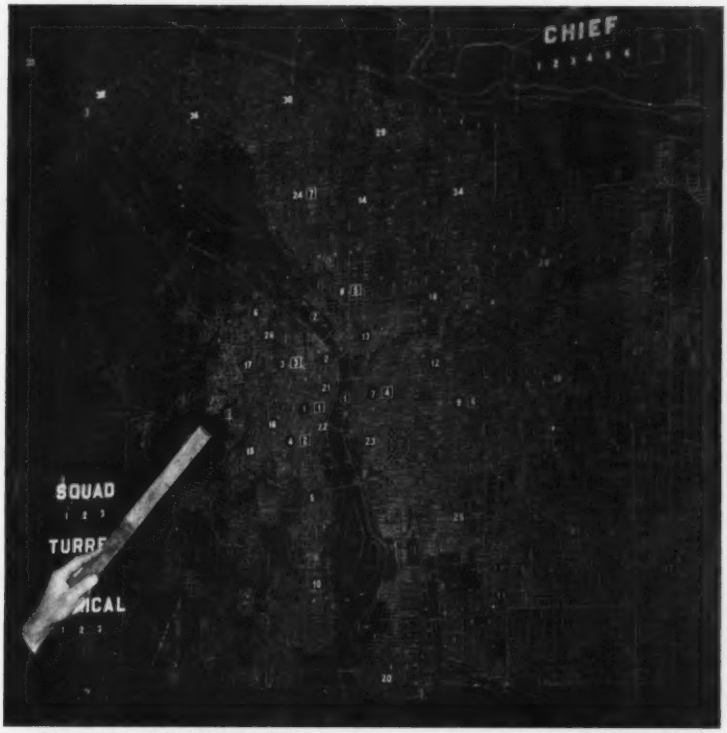
To meet the requirements of this plan it became evident that a radical change would be required in dispatching and transmission of alarms. After considerable study of the necessary fundamentals and a search for something that would accomplish the purpose, we decided to design our own equipment.

Control of Company Movements.

In developing our new dispatching system our first move was to design a map that would give the fire alarm operator a visual picture of the condition of the fire department at a glance, as follows:

1st. The exact location of all fires.

2nd. The exact locations of nearest available apparatus.



Fire alarm control map of Portland, Oregon. By means of this map, illuminated by miniature lights hidden behind the panel, the operator has a visual picture of the condition of department at all times. A yellow light indicates the location of a fire, a number shown in red indicates the company out of quarters, a number shown in green indicates that companies are covering in at these stations.

3rd. The apparatus out of service.

4th. The location of move-up companies during a multiple alarm.

5th. The location of Battalion Chiefs and auto mechanic at all times.

Flexibility is made possible by the unique construction of the map. A piece of plate glass with a white line city map on the inside forms the base to work from. This glass is placed in a steel sash frame which is hinged to another frame in which are placed all the lights, wiring, cable terminals, etc. The outside or face of the glass is clear and has no lettering on it. As all equipment is behind the white line print, nothing is visible but the map seen through the glass.

Engine and truck companies are geographically located and designated by the company number. For truck companies the number is in a square, for

fireboats it is in a circle, while for engine companies the number is used alone. A cluster of one red, one green and one white lamp is set directly behind each number. A piece of one-inch bakelite tubing is slipped over the cluster to shield the light from other numbers.

Fire location lights are distributed behind the map and are spaced according to scale and indexed by numbered lines in one direction and lettered lines in the other. The lights are arranged in rows corresponding to these lines and a light lit at the corresponding crossing of a number and letter will give the approximate location of the fire.

The fire location light itself will show through the black map with a dull orange glow, making a spot about two inches in diameter. The operator can tell at a glance the nearest companies in service and dispatch them to the fire.

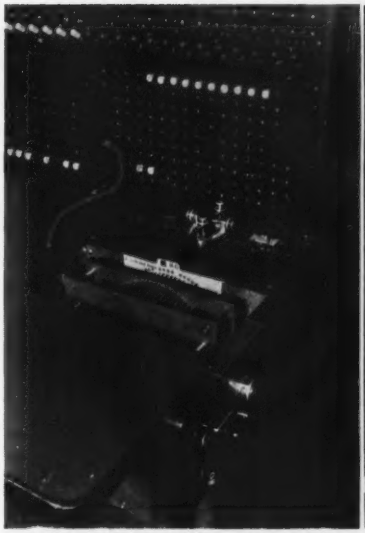
The control panel is a combination map control, plug-out board and station selector that we use with our card transmitter. Each station number on the map can be made to turn either red, white or green. If a company is out of service, its button is pushed and the company number turns red on the map. If the district chief is at a company station, the chief's plug is inserted in the hole for the company's plug and the number on the map turns white. If a move-up company occupies a station, that company's plug is inserted in the second hole below the number the company is moving into and the number turns green. When there is no light, the company is at quarters in service.

The plugs in the panel can be moved to any hole, just like a standard plug-out board. This panel is designed for 39 engine companies, 10 trucks, 3 fireboats, 3 chemicals, 3 turrets, 3 squads and 6 battalion chiefs. The fire location light holes are on the lower part of the board. The telephone keys are station selector keys and are used for a broken running card on the card transmitter or to tap out any house individually.

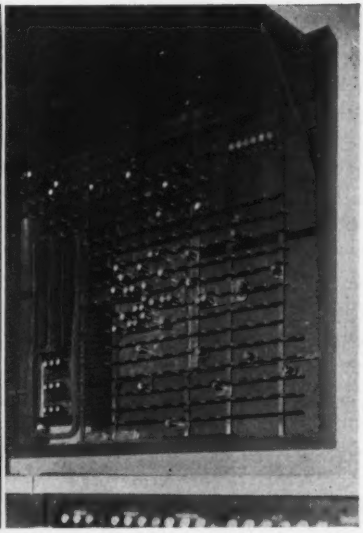
Transmission of Alarms.

The card transmitter is designed to automatically set up any box number up to twenty-five digits with four spaces. It will also select any number of fire stations that are to receive the signal. The box number is set up by a series of steel pins set on the segment of a circle. Another series of steel pins with platinum tips make contact with a silver plate. These pins close a local relay circuit that selects the companies to receive the signal. We use our regular running card with holes punched to correspond to the box number. Holes are also punched in the card to select the companies answering this box and to drop all traffic semaphores on the routes of these companies to the box location. The semaphores are timed for sixty seconds and automatically restore themselves to normal position.

The picture of the transmitter shows two switching keys, a telegraph key and a lever on the right side of the transmitter. When a card is placed in the



View of transmitter with running card inserted ready for transmission of alarm. Control panel in the background is a combination map control plug-out board and station selector.



Rear view of map, showing arrangement of lights, indicating location of fire companies. Directly behind each company number on the map is placed a cluster of one red, one green and one white light.

slot the lever is forced down. This brings the carriage, which carries the pins, up against the card. If there is a hole in the card, the pin goes on through and makes contact, setting up its part of the box number. The work of the pins in the segment is purely mechanical, the pin passing through the hole in the assignment card and tripping a lever as it passes the pin when the transmitter is running. This lever closes a relay that opens either the primary or secondary circuits. The two switching keys are controls over the primary and secondary circuits and the tap-out circuits in the transmitter. The telegraph key is used to send special signals over the primary and secondary circuits.

If a box comes in during the operation of the silent system, the operator selects that running card, drops it in the card transmitter and pushes the lever. The transmitter selects the companies answering the box, sets up the box number automatically and sends it to the companies that go, by ringing the alarm gongs in the selected stations. The rest of the department sleeps on until, in the judgment of the operator, or in event of a multiple alarm, a watch should be maintained. The operator then throws a switch and the transmitter simultaneously rings the tap-out or alarm gong in all stations, followed by 2-1-3 on the tape, which is a signal to put a man on watch. The operator then sends out what boxes are in and reports all companies out on

telephone calls. The man on watch arranges his plug-out board and stands watch until the signal 3-1 comes over the tape, which means that the danger is over—turn in.

Operation of System.

After carefully analyzing every move from the pulling of a street box to the rolling of the apparatus through the door of the fire station, we discovered that, on the average, a company can turn out of bed and roll as quickly as they can when scattered around the station. One man, sleeping in the watchroom, reads the tape and answers the telephone.

Let us analyze and time each individual operation from the first blow of an incoming alarm till the apparatus rolls. We have three operators on duty during the silent watch. Box 5746 comes in. Start your stop watch at the first blow of the incoming alarm at the fire alarm office.

At the completion of five, the operator pulls out the 5000 drawer, at the completion of seven, his hand stops on the left-hand guide, 700, at the completion of four, he had stopped at the right-hand guide, 40, at the completion of six, he has picked out his card—time 10 seconds.

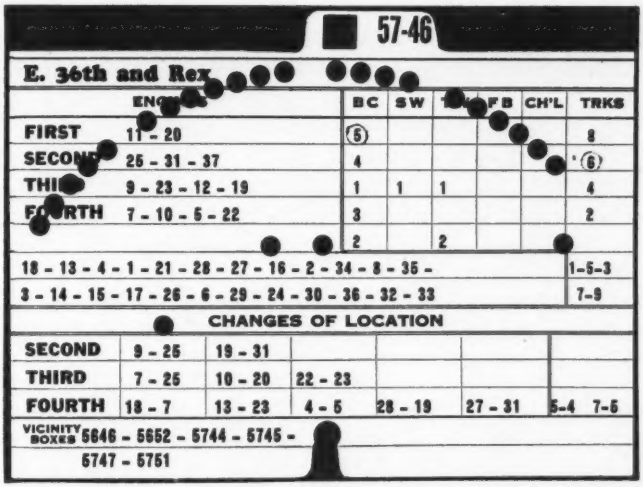
To drop the card in the transmitter and throw down the lever, tap out the companies and set up the box number, throwing the switch to primary which starts the transmitter—3½ seconds. To send out the first round of the box—10 seconds.

At 13½ seconds after we started our stop watch, the companies answering this box were tapped out by ringing the local alarm bells in the stations, and by the time the first round came in to them over the primary circuit, they were all dressed and on the apparatus, except the man in the watchroom, who gives the number of the box. They all know the location by heart. Let's give them ten seconds more to get out of the house and stop our watch. Time from pulling the handle down on fire alarm box until apparatus rolls out the door—33½ seconds. This is the time within which it is possible to get the apparatus under way. However, the average time will be about 15 seconds longer.

Our cards are only punched for the first alarm companies, and in case of a broken running card we go to the control panel for additional companies. For instance, Engines 11 and 20 are out on a telephone alarm and Box 5746 comes in. A glance at the map shows Engines 11 and 20 out, the operator drops the selector keys on the control panel on the next companies up, Engines 25 and 31, puts the card in the slot, throws the lever and Engines 25 and 31 are tapped out, receiving the box the same as those listed on the card.

All companies signal the fire alarm operator before leaving quarters. If a telephone alarm comes in while on the silent system, the operator drops the selector keys on the companies he wishes to call. This rings the alarm gongs in the stations and, as there is no signal on the tape, the man on watch goes to the telephone and gets his instructions.

We use our card transmitter during the day watch also, and get the apparatus moving from 10 to 15 seconds faster because they are tapped out one second before the box starts coming over their tape, and when they are tapped out they know they roll. When on day watch the transmitter sends the box out to all companies, but only rings the local alarm gongs on the companies that take the box.



57-46

E. 36th and Rex

	ENG		BC	SW		FB	CH'L	TRKS
FIRST	11 - 20		(5)					8
SECOND	25 - 31 - 37		4					(6)
THIRD	9 - 23 - 12 - 19		1	1	1			4
FOURTH	7 - 10 - 5 - 22		3					2
			2		2			
18 - 13 - 4 - 1 - 21 - 28 - 27 - 16 - 2 - 34 - 8 - 35 -								1-5-3
3 - 14 - 15 - 17 - 26 - 6 - 29 - 24 - 30 - 36 - 32 - 33								7-9

CHANGES OF LOCATION

SECOND	9 - 25	19 - 31				
THIRD	7 - 25	10 - 20	22 - 23			
FOURTH	18 - 7	13 - 23	4 - 5	28 - 19	27 - 31	5-4 7-5

VICINITY BOXES 5646 - 5652 - 5744 - 5745 - 5747 - 5751

Typical running card, indicating assignments for box 5746. The holes punched therein set up the box number in the transmitter, which selects the proper stations to which to transmit the alarm.

Direct Cost of Bad Fire Records.

Because of lack of statistical data it is not possible in most cases to show how, by means of insurance premium payments, individual cities are carrying the cost of fire waste. The situation in Texas, which is peculiar to that state, is such that figures are available covering fire insurance premiums and losses by cities. These are published annually in a booklet prepared by the Engineering Department of the Texas Fire Insurance Commission (member N.F.P.A.).

The practice was established in Texas some years ago in order to encourage fire prevention work, of granting cities a certain credit in the cost of insurance in return for a low loss ratio. As a means of making those with bad records bear a more proportionate share of the burden which their losses throw on the country, a penalty charge for a high fire loss ratio was also established which is added to the cost of insurance written in the city. All stock fire insurance companies and agents report premium and loss figures, making possible the calculation of loss ratios for each city each year. A charge or credit results according to what the average loss ratio may have been during the three preceding years, as shown by the following table:

Three-year Average Loss Ratio	Credit %	Three-year Average Loss Ratio	Charge %
Less than 35%	15	55-64%	0
35-39%	12	65-69%	3
40-44%	9	70-74%	6
45-49%	6	75-79%	9
50-54%	3	80-84%	12
55-64%	0	Over 85.%	15

The charge or credit is applied without disturbing the usual insurance rating procedure by making a flat addition to or subtraction from all insurance bills rendered. This practice has the effect of bringing directly home to the citizen the significance of fire prevention. The following table covering the cities over 20,000 population is submitted to show just how the cost of a bad fire record is assessed and to show the dollar and cents value of a good fire record in cities of various sizes.

Column A. The city is paying least in fire insurance when it is enjoying a 15 per cent Good Fire Record Credit. This reduces the normal annual premiums 15 per cent. The difference between this figure and that which would result from a 15 per cent Bad Fire Record Charge (a spread of 30 per cent) is given in Column A. This is the total amount which a city can save through a good fire record. It can be seen, for example, that a fire prevention campaign

Texas Cities Over 20,000 Population.

City	Population	Normal Annual Premiums*	A	Per Cent Credit (or Charge) 1932	B	C
Abilene	23,175	$227,350	$68,205	3	$40,923	$27,282
Amarillo	43,132	418,111	125,433	15	125,433	.....
Austin	53,120	420,144	126,043	15	126,043	.....
Beaumont	57,732	457,014	137,104	15	137,104	.....
Brownsville	22,021	89,752	26,925	15	26,925	.....
Corpus Christi	27,741	194,241	58,272	15	58,272	.....
Dallas	260,475	2,298,699	689,609	0	344,804	344,804
El Paso	102,421	436,811	131,043	0	65,521	65,521
Fort Worth	163,447	1,223,270	336,981	(6)	134,560	256,887
Galveston	52,938	522,773	156,832	6	109,782	47,050
Houston	292,352	2,584,910	775,473	12	697,926	77,547
Laredo	32,618	112,868	33,860	15	33,860	.....
Lubbock	20,520	159,553	47,866	0	23,933	23,933
Port Arthur	50,902	221,016	66,305	6	46,413	19,891
San Angelo	25,308	188,368	56,510	9	45,208	11,302
San Antonio	231,542	1,326,993	398,098	15	398,098	.....
Waco	52,848	417,454	125,236	(3)	50,094	75,141
Wichita Falls	43,690	462,729	138,819	6	97,173	41,646

*The annual premium figures before charges or credits are applied; based on 1931 premiums.

in Houston, Texas, is worth $775,000 annually, an amount providing considerable incentive to Houston citizens to make such a campaign successful.

Column B. The city is paying most in premiums when carrying a 15 per cent Bad Fire Record Charge. Column B shows the amount of premiums which it is estimated each city will save in 1932 because of good fire records. It is significant that only two of the 18 cities listed are carrying penalties.

Column C. The difference between the figures in Column A and Column B is given in Column C. This is the amount of premiums which it is estimated each city will have to pay because of bad fire records. These sums are large enough to make it worth while, especially in Dallas and Fort Worth, to maintain aggressive fire prevention campaigns, as these figures represent money which the citizens can save by their own efforts.

Cunard Steamship Pier Fire, New York.

Report by New York Board of Fire Underwriters,
(Member N.F.P.A.).

A spectacular fire starting early on the morning of May 6, 1932, destroyed Pier 54 located on the North River at Thirteenth Street in New York City. This pier, one of a group of three occupied by the Cunard Steamship Company, had superstructures of non-combustible construction. Property damage estimated at more than $1,000,000 resulted before the fire was brought under control twenty-four hours after its discovery. One man was killed, and a number of firemen were temporarily incapacitated by injuries and from the effects of smoke.

Description of Pier.

The pier involved in the fire was approximately twenty-two years old, but was in good repair. It was about 950 feet long and 100 feet wide, and was one of a group of three communicating piers of similar construction connected by a bulkhead building. The latter was about 55 feet in width and, like the pier superstructure, was two stories in height.

The pier deck and first floor of the bulkhead building consisted of 2-in. asphalt over 6-in. concrete on heavy pine planking resting on wood girders and piling. Only a few of the members of the substructure were creosoted. These were replacements. The piling of the two communicating piers showed a considerable deposit of bilge oil, and similar deposits on the burned pier undoubtedly augmented the combustibility of the piling and contributed to density of the smoke.

The second floors of the pier and bulkhead were of reinforced concrete, consisting of 4-in. flat arches on unprotected steel I-beams, spaced six feet on centers on unprotected steel girders supported by steel side construction and by interior unprotected steel columns. The pier sides were corrugated iron on unprotected structural steel, except that the river end was backed with 4-in. tile.

The west wall of the bulkhead building was corrugated iron on unprotected structural steel. The east or street wall of the bulkhead building was concrete. North and south, the bulkhead building was continuous with open communications to piers 53 and 56. Cargo doors at the sides of the pier were wood, tin-clad on both sides. The area of Pier 54 was about 94,500 square feet. The area of the bulkhead building was about 56,650 square feet.

The finish was open except for wooden stock racks on the pier, plaster on wire lath in offices of the bulkhead building and cement plaster on tile in the waiting room. The roof was slag on 1½-in. planks supported by unprotected

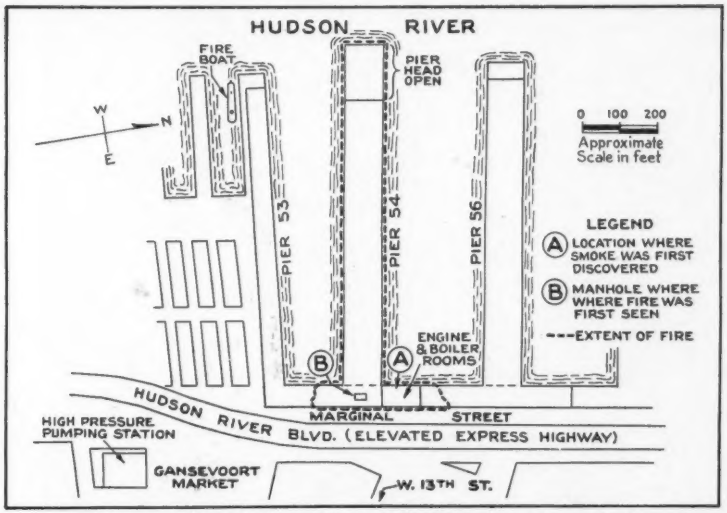


Diagram of Cunard Steamship Co. piers, showing extent of fire.

steel construction. The pier had a skylight of thin glass in wood frame extending its full length. There were numerous stairs, elevators, escalators and merchandise chutes in the pier superstructure and bulkhead building in various types of enclosures.

All three piers were open to the bulkhead building and there were no division or fire walls in either the substructure or the superstructure of the piers or bulkhead building, except for a concrete fire wall under the bulkhead building midway between Piers 53 and 54 and also midway between Piers 54 and 56. Piers 53 and 54 were from 180 to 240 feet apart and there was a 300-foot space between Piers 54 and 56.

Occupancy and Protection.

Pier 54 and the bulkhead building were occupied by the Cunard Steamship Company. The first floor of the pier contained merchandise in transit of a miscellaneous nature, and the second floor was used for baggage and waiting rooms. The first floor of the bulkhead building was not occupied except by boiler and engine rooms, and the second floor contained waiting rooms and offices.

The pier was equipped with a manually operated fire alarm system, watchman's service, first aid appliances, a standpipe and hose system, and a fire brigade. This equipment played no part in the fire other than the fact that a member of the fire brigade discovered the fire and used a hose stream from the standpipe system during its early stages.

Keystone-Underwood.

Cunard Steamship Co. Pier Fire, New York. As in other pier fires, the large area beneath the pier deck with wooden piles and timbers, no firewalls or other protection and no means of access for fire fighting, severely handicapped the fire department.

Story of the Fire.

The fire appears to have had its origin in the vicinity of the engine room under the first floor of the bulkhead building just north of Pier 54. It was discovered by one of the pier guards who observed smoke issuing from under the engine room at approximately 6:20 A.M. He also noticed a clouded atmosphere in the boiler room and saw that a small amount of steam was escaping from the safety valve of one of the boilers. He at first thought the smoke coming from under the engine room was also steam, but after a few minutes realized that it was smoke. No engineer or fireman was on duty on the premises after midnight, and the fires under the boilers were supposedly banked.

The guard who discovered the fire notified the sergeant of the pier guards, who sent for the pier electrician. The latter attempted to reduce the fire under the boiler and to reduce the boiler pressure, which was said to have been in the vicinity of 90 lbs. The sergeant sent two guards to get a boat which was located at the end of Pier 56, but the boat was too heavy for the men to launch. A pontoon in the water alongside Pier 56 was then pulled over to a point adjacent to the boiler and engine rooms. A ladder was lowered to the pontoon and the sergeant descended. He looked under the floor of the bulkhead building but could see no fire.

The smoke issuing from under the side of the bulkhead building continued to increase. A hose line from the standpipe system was passed out through a boiler room window and the sergeant turned the stream of water upon what he believed to be the base of the fire. After some minutes the smoke became thicker and the water was turned off, but no fire was seen. The water was turned on again and the smoke became worse.

At this point word was sent back to the office and a telephone alarm was transmitted to the fire department. The fireboat, berthed at Pier 53 near by, and land apparatus arrived within a few minutes. A small boat was lowered from the fireboat and firemen directed a stream beneath the bulkhead building toward the seat of the fire, which continued to defy discovery. It is stated that the first time that flames and fire were actually seen was when firemen lifted a manhole cover located at the entrance to Pier 54, approximately three-quarters of an hour after the fire department had arrived.

A second alarm was sounded one hour and three minutes after the first alarm, followed in ten minutes by a third, then in five minutes more by a fourth, and twenty-four minutes later by a fifth alarm. Subsequently numerous special calls were transmitted and tugs of several railroads and large corporations assisted the fire department from the water side. The fire spread beneath the bulkhead building for approximately 150 feet north and 75 feet south of Pier 54, and under the entire length of the pier.

Acme.

The burning Cunard Steamship Co. pier, New York. The fire had its origin beneath the bulkhead building in the foreground and spread to the combustible substructure of central pier. Land companies devoted their efforts to preventing the spread of the fire to other piers, while the extinguishment of the fire beneath the pier deck was left entirely to the fireboats.

The fire department concentrated their efforts upon preventing the fire from involving the entire bulkhead building and spreading to Piers 53 and 56. They called upon the Consolidated Gas Co. for air compressors and drills to pierce the 6-in. concrete floor of the bulkhead building in order to reach the fire. Numerous holes were finally cut, and by the use of cellar pipes and hose lines the fire was prevented from spreading throughout the structure and to the other piers.

In the meantime the task of the extinguishment of the fire beneath the pier deck was left entirely to the efforts of the fireboats. The operations of these boats were extremely ineffective, for their streams could penetrate only a short distance beyond the first line of piling. At 6:25 P.M. the day of the fire, or about twelve hours after the first alarm, a section of the pier settled into the river. By 7:30 P.M. the entire pier except for a portion of about 120 feet at the land end had so settled. The fire department continued to fight the fire under the floor of the bulkhead building, and it was not completely extinguished until over thirty hours after its discovery.

Cause of the Fire.

The cause of the fire has not been determined. The setting of the boiler was such as to involve little possibility of the fire having originated from that

View from bulkhead building at north side of Pier 54, showing how pier settled into the river when the supporting substructure burned away.

source. Ashes were removed three times a day, wet down immediately and removed to the street. These facts, coupled with the fact that the smoke was first seen approximately thirty feet distant from the boilers in which there was a fire, appear to definitely eliminate the boilers as the probable cause of the fire.

Located in a corner of the boiler room was a brick enclosed incinerator. This incinerator was set on two inches of common brick, on four inches of fire brick, over the concrete floor of the boiler room which at this point was ten inches in thickness. The grate of the incinerator was more than a foot above the fire brick at the nearest point. The incinerator was in operation from 8:00 A.M. to 3:00 P.M. the previous day, but in view of its location and setting it is not believed that it was responsible for the fire.

It was stated by the pier superintendent that on April 20, in company with several assistants, he had examined all parts of the pier, including all of the substructure beneath the boiler and engine rooms, and found no evidence of charring or other signs of fire. The examination was a routine matter in connection with repairs that had been proposed. There was no other equipment in the building to which the origin of the fire might be attributed except possibly the electrical equipment.

Loss.

The loss, which at the time of this report has not been adjusted, for the pier and portion of the bulkhead building, together with the contents, has been estimated in the vicinity of $1,000,000. The entire pier, other than the land end heretofore mentioned, settled into the river together with all the cargo

and equipment that was stored upon it. The second floor of the pier rests at approximately the level of the river and the damage to the superstructure of the pier was due almost entirely to its settling. The bulkhead building likewise suffered serious damage by the settling of the pier.

The death of one person, a spectator, can be attributed to this fire. The victim was an architectural engineer who, when the pier was built, had assisted in the design of the steel superstructure. He was killed when a hose line attached to a hydrant broke loose and the coupling struck him on the back of the head, fracturing his skull. A considerable number of firemen suffered from smoke inhalation or eye irritation, but no permanent disabilities are reported as sustained by the personnel of the fire department.

Conclusions.

There are no new lessons to be drawn from this fire, but it may well serve as a warning of similar fires involving pier substructures unless reasonable precautions are taken. An analysis of the factors involved in this fire indicates that, as in the case of the Rhode Island State Pier fire at Providence in February, 1931 (QUARTERLY, Vol. 24, No. 4), its rapid spread beneath the pier deck and the resultant large loss were due to four conditions—combustible construction beneath the deck; absence of automatic or open sprinklers, automatic fire alarm or other means of protection under the pier deck; inaccessibility of this area for fire fighting; and lack of fire walls, bulkheads or other means for restricting spread of fire.

The prompt use of private fire fighting equipment is to be commended, but in no instance should attempts be made to extinguish a fire in a structure of this type, no matter how insignificant, without first notifying the city fire department.

An interesting feature of this fire was the volume of water used. According to statistics published in *The Chief*, the total quantity of water from all sources was 82,945,143 gallons. The high pressure system delivered 28,000,000 gallons at 165 lbs. pressure from 6:54 A.M., May 6, to 5:41 P.M., May 7. Nine fire department pumpers at low pressure hydrants delivered a combined total of 5,497,920 gallons. The nine fireboats operated a total of 213 hours, delivering a total of 49,447,223 gallons. During the greater part of Friday, May 6, four boats worked simultaneously.—Ed.

State Office Building Explosion, Columbus, Ohio.

Engineering News-Record.

The new state office building in Columbus, Ohio, was seriously damaged by an explosion about 2:40 P.M. on Thursday April 14, 1932. The building was in process of construction and a large number of workmen were in the structure at the time engaged in completing the interior decorating and installing fixtures. Seven men were killed and three more have since died of injuries; 53 others were injured. The monetary loss has been variously estimated at from $750,000 to $1,000,000. The following account was provided by Clyde T. Morris, professor of structural engineering, Ohio State University.

Description of Building.

The building, which was scheduled to be turned over to the state on May 15, cost about $4,000,000 and is situated in the heart of the city on the east bank of the Scioto River. The main structure is twelve stories high, covering an area of about 29,000 square feet with a two-story addition 45 feet wide running the entire length of the west front. The structural frame is of steel

Columbus Dispatch.

Ohio State Office Building at Columbus seriously damaged by an explosion attributed to gas. Ten workmen were killed and more than fifty were injured.

Columbus Dispatch.

West front of building, showing the marble exterior facing in two lower stories shattered by force of explosion.

incased in concrete, and the floors are of reinforced concrete pan construction. The exterior walls are of hollow tile faced with Georgia marble and the interior partitions are of hollow tile. All floor girders are of steel incased in concrete. There are two banks of four elevators each, on either side of the main corridor which runs the full length of the building.

Story of Explosion.

The explosion occurred without warning at mid-afternoon while the building was filled with workmen engaged in completing the interior work. The center of pressure from the explosion seems to have been just west of the main bank of elevators in the sub-basement. The basement floor overhead was entirely blown off, as was the central portion of the first floor, embracing an area about 70 x 160 feet. In this area the concrete floors were raised clear of the supporting steel girders and then fell back into the basement, leaving the girders with a portion of the fireproofing still adhering to them.

The force of the explosion traveled up the elevator shafts, blowing out the partition walls on both sides in every story. The pressure thus released wrecked many of the interior partitions on every floor. The damage decreased in extent toward the top of the building, but considerable damage was done even on the top floor.

In the lower two stories the windows and doors on the west side were all blown out, taking the metal frames and sash with them. The west wall in these two stories is bulged, and in two bays much of the marble facing is entirely down, while in the others it is cracked and partly displaced.

With the exception of a few beams in the basement floor and the light framing around the elevator shafts, the structural steel frame is uninjured. A

Columbus Dispatch.

View of basement, which bore the brunt of the explosion. View shows wreckage, including débris from first floor, which was lifted clear of its supporting steel frame and dropped into the basement.

careful examination of the columns and girders, especially at the girder connections to the columns, fails to reveal any signs of cracking of the concrete fireproofing even at points where the damage to the floors was greatest. This would indicate that the steel frame is intact.

One remarkable fact is the completeness with which the concrete floors were destroyed by pressure from below. The concrete slabs were lifted bodily away from their reinforcing rods, leaving these almost as clean as new rods. There is no indication of injury to the foundations or to the concrete piers which are below the basement floor level.

Loss of Life and Injuries.

Seven men were instantly killed, three died later from injuries and 53 were more or less severely injured. Most of the casualties occurred in the basement or lower floors, but many workers on the upper floors were injured by the force of the explosion and flying débris, or were burned in the blast which followed. A group of city workmen laboring on the boulevard outside the building were injured by falling marble and flying glass.

Cause of the Explosion.

The official investigating committee appointed by Governor White in its preliminary report attributed the cause of the explosion to an accumulation of gas from an undetermined source in the subcellar. This sub-basement, which occupied an irregular area about 30 x 60 feet under the middle of the building, was without outlets except a manhole. A break was discovered in the gas main about 40 inches under the sidewalk fifteen feet from the west wall of the building. This break is described as being 11 inches long and about

one-twentieth of an inch wide at its widest point. One theory is that gas escaping from the main through this leak accumulated in the sub-basement and was ignited in some manner. Officials of the gas company deny that the leak was responsible for the explosion and insist that the break in the main was caused by the explosion and was not the cause of the catastrophe.*

*A letter of Donald J. Hoskins, Prosecuting Attorney of Franklin County, Ohio, transmits to the N.F.P.A. a copy of the conclusions of the committee appointed by Governor White to investigate the cause of the explosion. The report submitted by this committee states that, "It is the unanimous opinion of the members of this committee that the explosion of the State Office Building was caused by gas accumulating in the lower part of the structure. We have found no crater or other evidence of high explosives."

Beaver, Pa., Courthouse Fire.

By William E. Patterson.

Court documents and other invaluable records were removed to safety during a fire in the Beaver County Courthouse at Beaver, Pa., on May 26, 1932, thanks to the fact that the fire started at the roof and burned downward comparatively slowly. A fire-resistive addition at the rear of the building was used for the storage of other valuable records; this addition was not involved in the fire.

The building was of a type favorable for the rapid spread of fire. Built fifty-six years ago, it was a three-story brick structure with a mansard roof. The interior construction was of frame throughout, and open hollow partitions offered ample opportunity for fire to extend from floor to floor. Above the third story was a large open roof space, difficult of access. A clock tower containing a large clock and bell was located at the front of the building, rising to a height of approximately 100 feet.

Thanks to the start of the fire at the roof, there was time to remove valuable court records without damage other than from smoke, water and confusion incident to their hasty removal.

Story of the Fire.

The fire had its origin shortly before 10:00 A.M., and was caused by painters who were using a blow torch to burn paint from ironwork on the roof. It is thought that flames from the torch may have ignited the dry timbers under the metal surface through a crack.

Burning of the Beaver, Pa., Courthouse, ignited by a painter's torch on the roof, with loss estimated at $100,000.

An unsuccessful attempt was made by the workmen to extinguish the fire, occasioning a delay in sending in the alarm of approximately thirty minutes. When the Beaver firemen arrived the roof space in which the fire originated was completely involved and the flames were spreading into the high clock tower. The firemen stretched three lines of hose to the upper floors of the building and attempted to reach the seat of the fire in the large loft between the top floor and the roof, but there being no entrance to the loft available, their efforts were without avail. Heavy clouds of smoke, increasing in volume as the fire worked its way downward through the partitions, hampered the firemen in their fight to gain control of the fire and save the historic structure from destruction.

Realizing the impossibility of controlling the fire with the equipment at hand, the chief called upon half a dozen neighboring towns for assistance, and eight pieces of apparatus, including three pumpers and two ladders, responded. There was an ample water supply and ten hose streams were used in extinguishing the fire. While firemen were fighting the flames court officials, employees and volunteers removed large quantities of valuable records, law books and other contents from the various offices. About an hour after the start of the fire the clock tower crashed down, narrowly missing several persons who were carrying out books and documents. The large bell fell through into the main hallway on the second floor.

Four hours after the start of the fire it was considered under control, although firemen continued to use hose streams for several hours longer. All of the structure above the second floor was burned out and the lower floors

were badly damaged by water. As practically all of the movable contents of the building were saved, the only loss other than to the building was slight smoke and water damage to the records and the necessity of sorting and rearranging the records after their hasty removal. To this must be added the inconvenience of not having quarters for the courts. The loss has been estimated at from $85,000 to $100,000.

Drydock and Tanker Explosion, Montreal.

The floating dry dock of Canadian Vickers, Ltd., located about seven miles from the heart of the city of Montreal, P. Q., was the scene of an explosion and fire early on the morning of June 17, 1932, in which thirty men lost their lives and many more were severely injured. Among those killed were four members of the Montreal Fire Department, one of whom was Chief Raoul Gauthier (member N.F.P.A.).

The explosion occurred while the oil tanker *Cymbeline,* out of Liverpool, was undergoing repairs in the dock. The tanker, as a result of going ashore in the St. Lawrence River the latter part of April, was receiving repairs and replacements to the steel plates in her hull. A portion of the ship's cargo of fuel oil had apparently been removed from the tanks and was stored in tanks in the steel walls and floor of the dry dock.

Story of the Fire.

In the early morning hours of June 17 a night crew of approximately 100 machinists, riveters and helpers were busily engaged about the *Cymbeline* rushing the work of repairs, when without warning at about 3:30 A.M. a terrific explosion occurred. A shower of blazing oil was thrown over the dry dock and ship and the flaming liquid poured down the hatchways completely sealing the exit of a group of men working in the hold.

The members of the crew, numbering over thirty, were thrown from their bunks in the fo'castle by the force of the explosion, but all of them succeeded in making their escape. Workmen on the deck, their hands and faces burned and their clothing aflame, struggled to escape from the rapidly spreading fire. Some succeeded in reaching undamaged portions of the dry dock and thence to shore, others plunged forty feet into the water alongside the dock, while still others fell to the burning floor of the dock or were burned to death where they stood.

About 4:30 A.M. after an hour's work by the fire department the fire in the superstructure of the ship appeared to be under control and three firemen,

This report is based upon the best information available to the N.F.P.A. Department of Fire Record at the time this QUARTERLY goes to press. It is believed substantially correct, but pending the announcement of the result of the official investigation the details cannot be verified.—Ed.

led by their chief, went aboard the ship in a desperate effort to effect a rescue of some of the workmen trapped below decks and to get at the seat of the fire. Hardly had they reached the deck of the ship when another terrific explosion occurred, accompanied by a mass of flames. One of the men was burned to death in full view of his comrades, two were burned in the wreckage and the chief was blown overboard into the river, from whence his body was recovered a few days later.

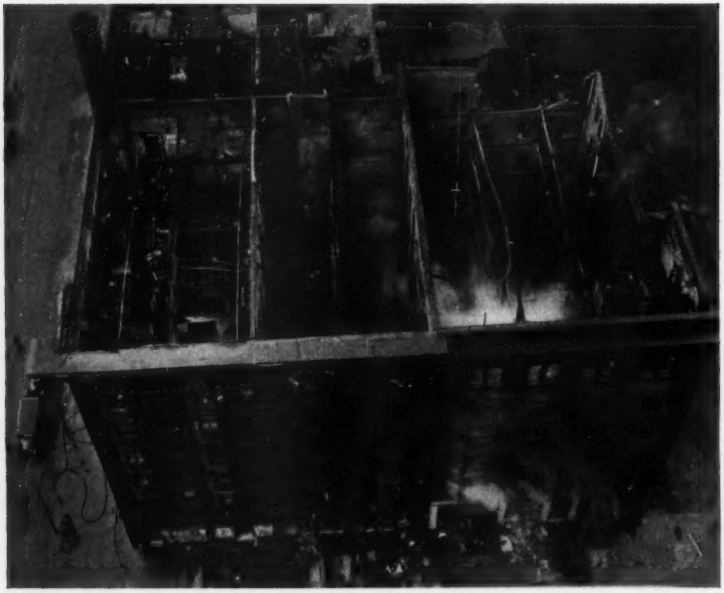
This second explosion is thought to have been due to the heat generated by the original fire which heated and vaporized the oil in the tanks of the dock. The superstructures again became a mass of flame which, however, after the first fierce outbreak again yielded to the effect of the fire department's hose streams. It was afternoon, however, before the firemen were able to enter the ship to recover many bodies.

The cause has not been definitely determined, although numerous theories have been advanced. An inquiry into the disaster is under way by the Admiralty Court. The dry dock and the tanker were both badly damaged and the dock settled sufficiently to cause some concern. The property loss was estimated in the vicinity of half a million dollars.

Keystone-Underwood.

Firemen playing hose streams on the wreckage of the tanker "Cymbeline" and dry dock at Montreal after the explosion which cost the lives of twenty-six workmen and four firemen, including the Chief of Department.

Ellington Apartments Fire, Cleveland.



Unprotected vertical openings and generally inferior construction were factors in the rapid spread of a fire which occurred shortly after midnight on June 7, 1932, in the Ellington Apartments in Cleveland, Ohio, as the result of an explosion supposedly of incendiary origin. Thirteen persons lost their lives and twenty-four occupants, the night watchman, and eight firemen were injured.

Egress from the building was provided by interior stairways and outside fire escapes on three sides. Ladders raised by the fire department were also used by occupants in escaping from the fire. The building was so quickly enveloped with fire following the explosion that it seems remarkable that more occupants were not trapped.

A single source sprinkler system covered the basement and first floor, and there was a supply of chemical extinguishers on the upper floors. The fire spread too fast, however, to make possible the use of the first aid equipment and the explosion which preceded the fire wrecked the sprinkler system.

Port Alfred Pulpwood Fire

On April 29, 1932, a fire of more than usual significance occurred in a 221,000 cord pulpwood pile at the plant of the Canada Power and Paper Corporation, Port Alfred, Quebec. This pile, possibly the largest ever accumulated in the paper industry, was the largest pulpwood pile that has been on fire and the greatest pulpwood loss to date, so far as known. The long duration of the fire permitted expedients that would not ordinarily be feasible and the story of the fire is a splendid example of the efficient utilization of all possible resources.

In spite of the energetic efforts of the large force of fire fighters, and in spite of the large quantities of water which toward the end reached 30,000 gallons per minute, the fire advanced slowly for twelve days and destroyed most of the pile with a loss estimated at $2,500,000. The progress of the fire was finally checked, however, so that it did not endanger the mill and approximately 40,000 cords of wood were saved.

System of Piling and Size of Pile.

The system of piling pulpwood at this plant consisted of a steel frame bridge of the suspension type with three steel towers approximately 175 feet high and spaced 420 feet apart on a line practically north and south. The steel towers were encased in concrete to the elevation of 125 feet, above which they were unprotected. The steel bridge was also unprotected.

This conveyor was designed for a maximum storage of 150,000 cords, but during the fall of 1930 this capacity was increased to 221,301 cords by means of sluices extended from the conveyor over the top of the pile. This had the effect of flattening out the normal slope of the pile and extending the areas of the base. Close piling to a height of thirty feet or more was resorted to on the east side to hold the wood back from contact with the slasher mill and the frame conveyor from this mill to the drum barker plant. Close piling to a lesser extent was resorted to along portions of the west side.

As a result of this excess storage the base of the pile was extended to a length of approximately 1500 feet with the north end of the pile practically adjoining the drum barker plant and reaching to within about 100 feet south of the wood room. The widest portion of the pile, on a line east and

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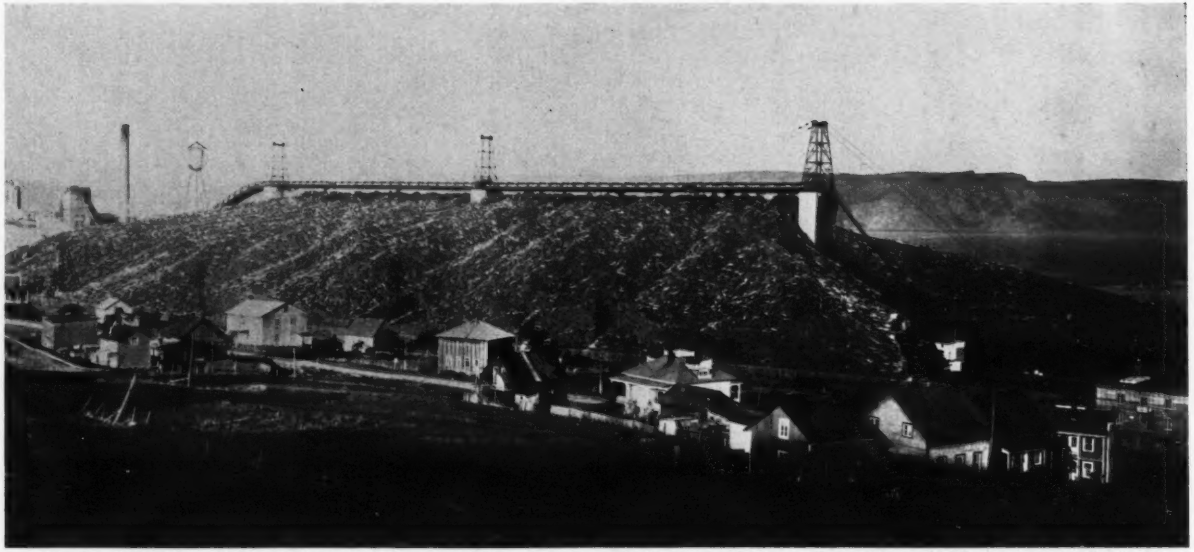
This article has been extracted from a complete illustrated report published by the Canadian Fire Underwriters Association (Member N.F.P.A.). The illustrations have been furnished through the courtesy of the Associated Factory Mutual Fire Insurance Cos.

Mr. L. H. Kunhardt (Member N.F.P.A.) gave an account of the fire at the annual meeting of the Association in Atlantic City on May 11, based on his personal observations during a visit to Port Alfred during the fire. In view of the publication of the present article the report of Mr. Kunhardt's remarks has been omitted from the Proceedings, as his principal observations are covered in the present text.—Ed.



The Port Alfred pulpwood pile before the fire. This pile was 1500 ft. long, 600 ft. wide at the widest point, and 120 ft. high. It contained 221,301 cords. The mill buildings may be seen beyond the pile at the left, at the right the waters of Ha Ha Bay.

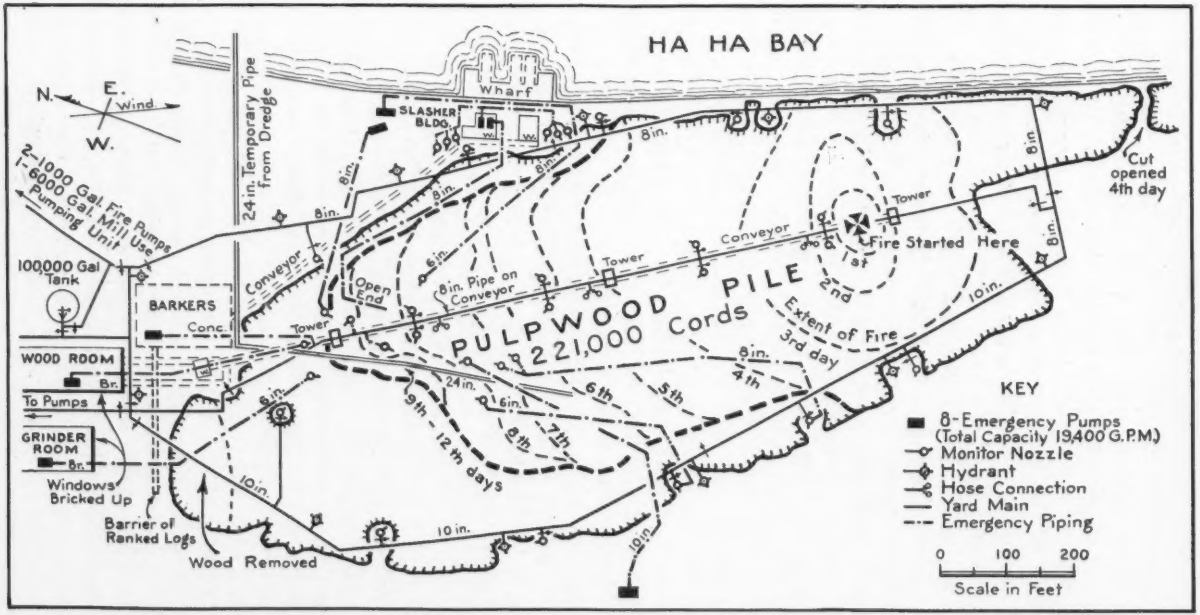


Diagram showing the outline of the Port Alfred pulpwood pile, the location of the emergency pumps, and the layout of the temporary monitor nozzles and piping on the pile when the fire was brought under control.

west, was approximately 600 feet at a point 500 feet south of the wood room, and from this point decreased somewhat in width forming a base somewhat similar to a section through the center of a dirigible from nose to stern. The ridge of the pile was approximately 120 feet above grade.

All of the wood had been in storage for not less than eighteen months, and approximately forty per cent was at least two years old. All the wood in the pile was spruce, four foot lengths, and had passed through drum barkers and was, therefore, cleaned of bark.

Exposure.

The north end of the pile at the time of the fire was about ten feet south of the drum barker plant, the construction of which is heavy reinforced concrete, having a superstructure consisting of two or three levels of plank platforms on unprotected steel, and an extensive conveyor system with plank troughs, frame motor control rooms, etc. This superstructure was protected by a dry pipe system of automatic sprinklers. The north end of the pile also extended to within approximately 100 feet of the brick, sprinklered, wood room.

On the east side the pile extended to within about ten feet of the frame, sprinklered, slasher buildings and practically adjoined a frame conveyor extending from the slasher to the barker plant. Close piling was resorted to along this side to hold the wood within bounds. There are also railway sidings along this side at a distance of 60 feet.

Along the west side at a distance of about 15 feet is a branch line railway track over which coal-fired steam locomotives operate when conditions require. Beyond the track are frame dwellings and sheds approximately 100 feet distant from the pile. These exposed buildings were wet down when the fire was nearest to them.

Protection for Pulpwood Pile.

The protection for the pulpwood pile consisted of an underground loop main, 48 per cent of which was 10-inch and the remainder 8-inch cast-iron pipe, supplying eleven monitor nozzles on steel towers and twelve three-way hydrants located around the pile. An 8-inch main extended along the overhead conveyor bridge with connections to the underground main at each end. This overhead main supplied eight monitor nozzles and six $2\frac{1}{2}$-inch hose connections.

In addition to this protection there was an underground loop main around the group of main buildings which supplied a considerable number of hydrants, some of which were available for the pulpwood pile.

Normally the primary water supply for monitor nozzles, hydrants and sprinklers was a 1000-gallon steam driven centrifugal pump, automatic at 80 lbs. pressure. A 300-gallon auxiliary pump maintained a pressure of 140 lbs. on all fire mains and sprinkler systems. The secondary supplies consisted of a 100,000 gallon steel gravity tank elevated 158 feet above grade on an independent steel structure and a 1000-gallon electrically driven pump.

The above pumps took suction from the mill supply main and had, as an auxiliary supply, connection to a 150,000 gallon reservoir fed automatically from the mill supply main. There was a 6-inch connection from the town of Port Alfred with a pressure of 85 to 100 lbs. A six-inch connection was also provided from 24-inch and 36-inch wood stave pipes, which are supplied by gravity from Ha Ha River about two miles distant. Pressure on these mains at the plant was 38 lbs. The valves controlling these connections were normally kept shut.

In addition to the fire pumps there were five mill service pumps with a rated capacity of 6000 gallons per minute each, against a head of 150 feet. These pumps were fed by the above mentioned 24 and 36-inch wood stave pipes. Two of these pumps were connected in series and could discharge into the fire protection mains through a 10-inch connection, normally maintaining a pressure of 135 to 145 lbs.* The remaining three pumps were single units and could discharge into the fire mains through the same 10-inch connection, against a head of 150 feet.

Plant Activities.

Due to conditions in the newsprint market the plant was shut down early in January, 1931, and had not since operated. However, during the weeks just previous to the fire preparations had been going on for the resumption of operations on Monday, May 2. For this reason the conveyor over the wood pile had been operated for a short time about one week prior to outbreak of the fire to determine if in order and it is stated that the plank conveyor trough had been thoroughly wet down both inside and out before starting and during operation. At the time the fire was discovered approximately seventy men, including department heads and a moderate office force, were actually employed about the plant.

Story of the Fire.

The fire started at about three o'clock, Friday afternoon, April 29, at the top of the pile near the south end. It was discovered by two electricians who were working on the conveyor. At that time the fire covered an area about five feet in diameter and the flames were licking the bottom of the conveyor trough and plank walkway. One of the men ran north on the conveyor bridge to give the alarm while the other stretched a hose line from a $2\frac{1}{2}$-inch hose connection on the conveyor bridge, but no water was discharged due to the fact that this overhead main was shut off on account of cold weather. In the meantime other persons on the wharf at the far end of the plant discovered the fire as did also residents of the town of Port Alfred, and telephone calls were received in the mill offices almost simultaneously with the alarm given by the employee on the conveyor.

*NOTE: The two 6000-gallon mill service pumps which are connected in series were at time of fire and had been in continuous operation for a considerable period prior to the fire, pumping into fire mains, maintaining pressures of 135 to 145 lbs.

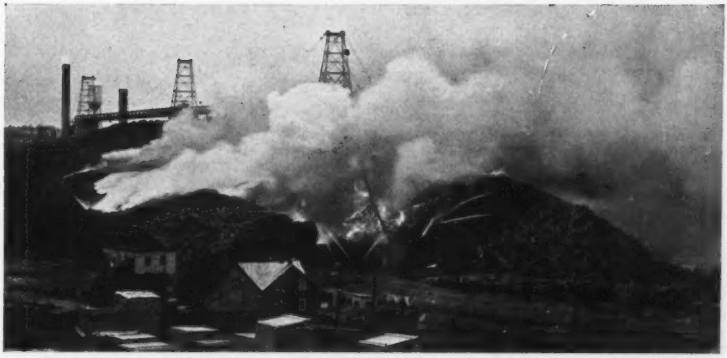
The alarm was promptly sounded on the mill whistle, calling out all employees of the plant. A hose line was stretched from a hydrant on the east side up the slope of the pile. It is estimated that not more than seven or eight minutes elapsed from the time of notification of the fire until this stream was brought into play. Meanwhile the valves controlling the overhead main on the conveyor were opened and a hose stream and two monitor nozzles were put in operation from the conveyor at about the same time as the stream from the hydrant. By this time the fire covered an area about 30 by 40 feet and was enveloping the conveyor trough and walkways.

As the employees began to arrive at the scene in response to the alarm other streams were brought into play and within the next ten minutes two monitor nozzles mounted on the conveyor were put in service and also a second hose line from the conveyor, plus still another line from a yard hydrant. These streams extinguished the surface flame about twenty minutes after the fire was discovered. The fire, however, had already begun to burrow downward very rapidly because of the wood-refuse which was present down through the pile under the conveyor. In another ten minutes, three more hose lines were taken up from yard hydrants. They were supplied by two 1000-gallon fire pumps and a 6000-gallon mill-use pumping unit which had been promptly started.

While these nine streams were being applied at close range, the men started to remove wood, trying to get at the burrowing fire. They had gone down about 20 feet when the smoke and heat drove them away. They continued to remove wood in the vicinity, particularly just north of the fire, with the idea of heading it off from the main bulk of the pile. Employees had come from the village and by midnight at least 650 men were at work. Fifteen hose streams and two monitor nozzles were then in use. As the fire burrowed deeper, the heat increased, and two hours after midnight flames again appeared. Attemps to dig down to the seat of the fire were then abandoned as useless. Four more streams were added. Practically a dead calm prevailed, but at daybreak a moderate east wind arose.

Saturday morning the monitor nozzles on the conveyor were abandoned because of the heat, but were left discharging into the fire. A 4-inch mill-use pipe on the conveyor delivered water on the fire through an open break made in the line. Twenty-six hose streams were in service, some to wet down the pile around the fire to prevent its spread over the surface. About 7500 gallons of water per minute was being delivered.

Shortly after noon, an attempt was started to cut the pile in two by opening up a clear space in the center. Men began to remove logs at the base and to slide them down a hastily erected conveyor into the bay. This work went ahead rapidly at first, but became difficult when the frozen logs not far under the surface were reached. Dynamite was used, and the work continued



View from south of pile on Monday, May 2, showing crater. (See frontispiece for photograph taken May 3.)

through Sunday, but the plan was abandoned early Monday morning when it was apparent that progress was too slow.

Meanwhile a plan of campaign was laid out and arrangements were made to obtain additional emergency pumping capacity, which it was hoped might succeed in drowning the fire. Other plants as far as 50 miles away sent pumps, piping, and other equipment. Mill-use pumps, motors and piping were taken from the plant and set up at the wood pile. The speed and resourcefulness shown in locating these heavy pumps, stringing power lines, and laying suction and discharge piping were eventually to prove of the utmost importance.

Sunday morning, May 1, the wind from the east increased in velocity and the spread of the fire became quite rapid. Fighting continued with essentially the same equipment as the day before. At midnight on Sunday, the first of the emergency pumps, rated at 3500 g.p.m. and set up in the slasher building, went into service. It took suction from a 16-inch mill-use main and discharged through the open end of an 8-inch pipe near the top of the pile. Four hours later a 6000-gallon pump on a flat car started to discharge through a 4-inch nozzle at the top of the pile. These pumps appeared to have no immediate effect. During Sunday, the openings through the base of the center conveyor tower through which the return conveyor passes, were blocked up with bags of cement which, after being placed in position, were wet down to prevent draught and spread of fire through this tunnel. Later similar openings in the north tower were bricked up.

During Sunday night or early Monday morning the situation became alarming and protective measures for the plant were begun. These consisted of demolishing all frame conveyors in vicinity of the wood room as well as the superstructure of the drum barker plant and at noon the same day a large fleet of trucks was placed in service removing wood from north end of the pile, this for the double purpose of salvage and protection of buildings.

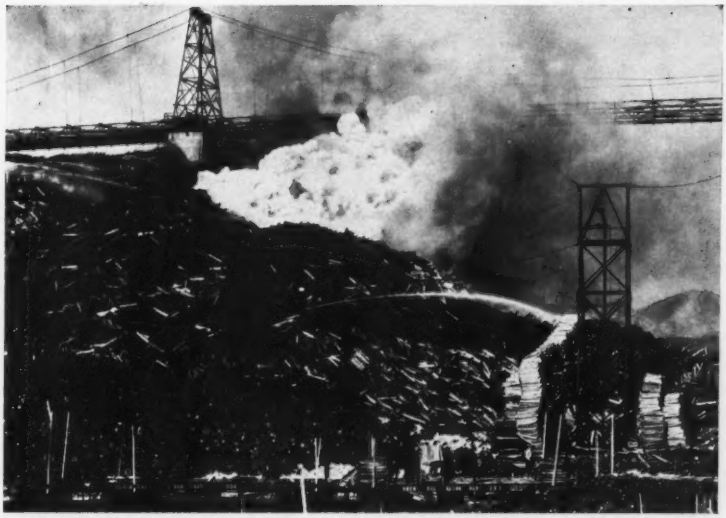
Monday the fire burned down to the edge on the east side. The intense heat weakened an unprotected steel monitor-nozzle tower, causing it to collapse and break the pipe so that it was necessary to shut off a portion of the yard system. That night the fire reached its maximum intensity. The entire south end of the pile, probably about 60,000 cords, was on fire. The conveyor steelwork was at a white heat, but did not collapse because the towers and suspension cables remained intact. Extending several hundred feet southerly from this end of the pile was a ranked storage of valuable boom logs, which was saved by opening up a clear space of about 40 feet. Meanwhile, the wind had shifted to the northwest and continued from this quarter for the remainder of the fire.

Early Tuesday morning, May 3, an 8-inch pipe line was connected to the riser of a monitor nozzle on the west side of the pile and extended up to near the top of the pile and water allowed to flow out of the open end. This line was in operation until the afternoon, when it was discontinued due to reduction of pressure on hose streams being used to wet down the top of the pile.

At about 7:30 A.M. Tuesday, a third emergency pump of 2500 gallons per minute capacity was transferred from the plant to the slasher building and placed in service discharging through an 8-inch main to a 2½-inch nozzle at a point approximately 150 feet from the building. A wood slide soon occurred burying a portion of the line and about noontime that day three monitor nozzles were assembled on the header immediately south of the slasher building and connected to this pump.

Continuing protective measures for the plant, the work of bricking up windows in south end of the wood room and grinder building was begun. The projecting roof of wood room was cut back and the brick wall extended above. As a further measure of protection, hose lines were laid on practically all roofs. An open sprinkler system was installed on the southerly portion of the wood room roof and west side of the slasher building. The sprinklers on the latter building were placed in service immediately on completion and a continuous hose stream was played on the roof. A barricade of close piled wood, 12 to 14 feet high, and approximately 100 feet long, was erected between north end of the wood pile and the wood room so that in case the fire ate through the wood pile, men standing behind this protection could use streams on the adjacent buildings.

In view of the possibility of the slasher building becoming involved, the suction line, supplying the three emergency pumps located in or near this building, was extended approximately 200 feet north on Tuesday. Early Tuesday night it was feared that the building would become involved within a short time and the 6000-gallon mill supply pump which was operating on a railway car east of the building was disconnected and moved out to the end



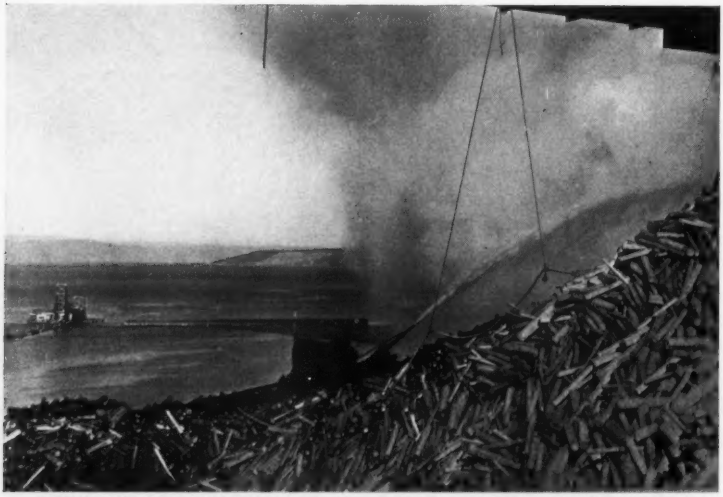
The fire on Wednesday, May 4, from west side, showing salvage of wood in foreground. Fire was out of range of the monitor nozzle.

of the new suction line. Suction connections were made and a new 8-inch discharge line was laid to the top of the pile and the pump was again placed in service on Wednesday, discharging through a 4-inch nozzle. During Tuesday night a locomotive crane stood by to lift out the two remaining pumps at a moment's notice.

By Tuesday night almost half of the entire pile had been reduced to huge mounds of glowing charcoal which radiated intense heat. In spite of the heat, however, two lines of hose were entered on the east side of pile at a point approximately 150 feet south of the slasher building. These lines gradually worked in between the hot mounds and the unconsumed outer edge of the pile which was burning on the inner face. This edge of the pile was close piled with end of logs to center line of pile. These hose streams together with the close piling were the main factors in saving the slasher building.

On Wednesday night a flank operation was executed on the west side and from this time tremendous quantities of water were played on the burning face of the pile and on the hot mounds from the lower level, while large volumes from open end pipes discharged over the burning face from top of pile. At the same time many hose streams were in continuous use wetting down top surface of pile.

On Monday arrangements had been concluded for the use of a suction dredge stationed in the harbor at Chicoutimi, which it was believed would be of considerable value. This dredge arrived at Port Alfred about 6:00 P.M. Wednesday, May 4, and in the meantime other necessary equipment for



Looking towards Ha Ha Bay from north part of pile. The dredge "Montcalm" may be seen in the left background, with a portion of the 24-in. discharge pipe on pontoons. In the foreground is a 4-in. stream from an 8-in. line fed by the 6000-gallon mill pump near the slasher building.

operating the dredge was being assembled. This included transportation by truck of a special transformer from Arvida, and 2000 feet of 24-inch discharge pipe and pontoons from Chicoutimi. Approximately fifty per cent of this 24-inch pipe was laid on pontoons as the dredge could not come nearer to shore due to shallow water. The remaining pipe was laid on the ground and up the slope of wood pile. This entire operation was completed in one day. It was also necessary to connect up the transformer to the plant's power lines and extend a transmission line to dredge. This dredge was placed in service at 12:30 A.M., May 5, discharging from 12,000 to 13,000 gallons per minute. The discharge from this dredge at the brink of the advancing front of the fire had considerable cooling effect and slowed up the fire at the point where it was applied.

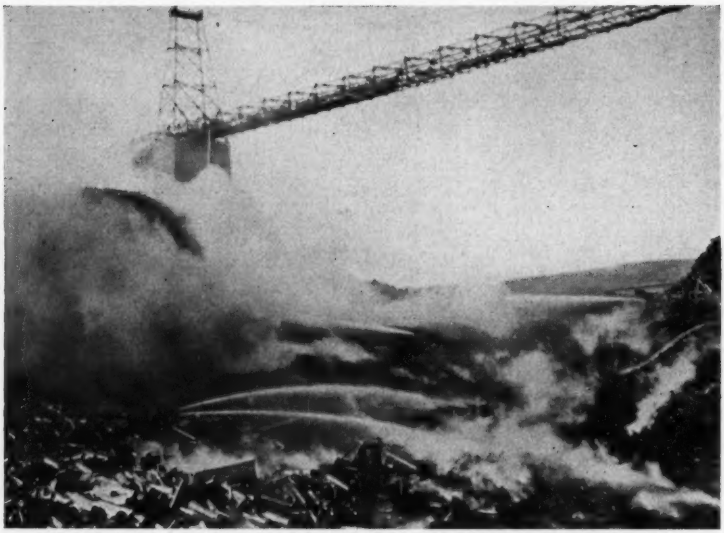
On Wednesday, May 4, the 8-inch fire main extending over conveyor bridge was broken at a point near north face of fire. The north end of this main was connected to the mill supply line in the barker plant and water allowed to flow through the open end.

In addition to the removal of wood from the north end of the pile for the dual purpose of protecting buildings and salvage, work was commenced in removing wood from the west side of the pile, Wednesday noon, for salvage purposes. This work together with removal from the north end was discontinued Thursday due to the frozen condition of the pile and the consequent slowing up of the operation.

The 24-in. pipe from the dredge "Montcalm" discharging from the steel trough to the rim of the fire crater. This picture was taken on Thursday, May 5, looking southeast.

The water which was being constantly applied along the advancing edge of the fire did prevent it from spreading over the surface, but the really effective work was accomplished by the increasing number of high-pressure streams which were being put in use directly against the burning face of the pile. Pipes supplying temporary monitor nozzles close to the base of the vertical wall were laid over the smoldering logs and charcoal, fire on the surface of which was kept down by hose streams. One stream in particular was unusually effective—a $2\frac{1}{2}$-inch stream at 165 pounds nozzle pressure which bored into the pile with tremendous force. It was supplied by a fourth emergency pump delivering 2400 gallons per minute at 225 pounds pressure. This pump had arrived by special train on Saturday from a town thirty miles away, but it burned out its bearings when started. It was repaired in a few hours, and then motor trouble developed. Electricians worked on the motor until Thursday, after which the unit was put in service, increasing the total delivery to about 30,000 gallons per minute.

The combined effect of preventing the spread of fire over the top of the pile, and of extinguishing it on the vertical face, gradually brought the fire under control. By Sunday, May 8, the ninth day, the fire had been extinguished along the inside of the west wing. On Monday, the east side and wing were extinguished by two open 8-inch pipes and a number of high-pressure streams. From then on no more flame was visible, but smoke continued to be given off from the center portion. On Tuesday evening the men started to remove wood to get at the small amount of fire which remained. This work continued late into the night and by daybreak Wednesday, May 11, the



Fire fighting operations inside the crater in the later stage of the fire.

last of the fire had been uncovered and extinguished. During these last few days, four more emergency pumps were put in service.

Excellent work kept the fire from spreading over the surface. By bringing into play the emergency pumping equipment of enormous capacity, it was finally brought under control, preventing serious exposure to the mill and saving about 40,000 cords. The danger to the mill would have been greatly increased if the wind had shifted to the south. Contrary to newspaper reports some days after start of the fire to the effect that hope of saving the wood pile and plant had been abandoned and all efforts were being concentrated on saving the town of Port Alfred, efforts were being redoubled and additional pumping capacity, hose, pipe, etc., were being placed in service directly on the fire. The frame houses of the town were subjected to intense heat and sparks from the wood pile, but no equipment was at any time diverted from the pulp wood fire except during a part of Monday, May 2, Tuesday, May 3, and Wednesday, May 4, when two streams from the Chicoutimi fire department pumper were directed on frame sheds and dwellings detached 100 feet and more from the wood pile at the west. These buildings escaped with practically no damage.

The fire was considered officially out at about 6:00 A.M. Wednesday, May 11, after having burned for eleven days and fifteen hours.

Cause and Loss.

The cause of the fire is not definitely known, but under the conveyor was a quantity of fine wood refuse, consisting of small splinters and pieces of bark.

The fire was considered out at 6 A.M. on Wednesday, May 11, but a number of streams were kept in service as shown in this picture.

There had been no rain for several days and this refuse was very dry. In contrast of clean, barked logs, this refuse easily ignites and spreads fire. It was probably ignited by a spark from an unknown source.

The loss to the company from the fire, including the cost of salvaging operations, was estimated in the vicinity of $2,500,000. Approximately 40,000 cords of wood was saved.

How the Fire Was Fought.

As indicated in the story of the fire, great credit must be given to the mill men for the prompt and thorough organization for handling the fire. After the arrival of the insurance representatives, frequent conferences were held between the mill officials and the insurance men and the conclusions arrived at were at once communicated to those who actually directed the fire-fighting force. It was realized by the mill employees that the destruction of the pile would prevent resumption of operations at Port Alfred, and as the mill had already been shut down for a long period, the employees knew that their jobs depended on the control of the fire. An emergency kitchen was established in the plant and several thousand meals were served daily.

The equipment used in fighting the fire was as follows:

MILL FIRE PUMPS.

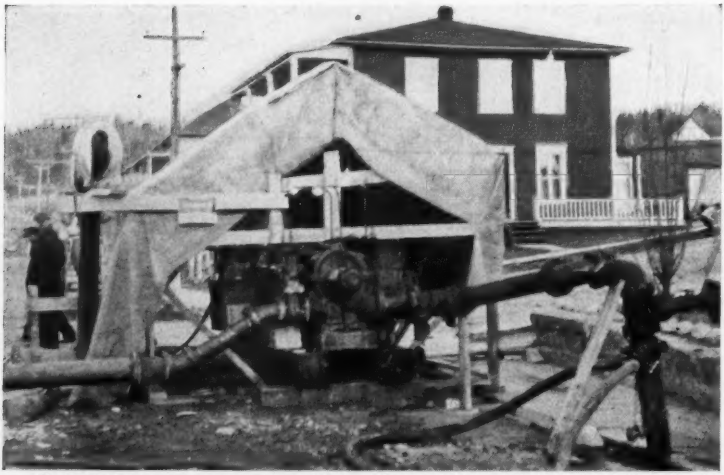
Two 1000 g.p.m. pumps connected to fire mains normally operating at a pressure of 135-145 lbs.

Two 6000 g.p.m. mill service pumps, connected in series. These pumps had been pumping into fire mains for some time previous to the fire.

MILL SERVICE PUMPS.

Two 6000 g.p.m. pumps connected to service mains.

One 6000 g.p.m. service pump removed from pump house and put into operation on a flat car on Monday, May 1, discharging on to the pile through an 8-inch pipe line and a 4-inch nozzle.



One of the emergency pumps. Note substantial installation, with flood light and warning sign. This is typical of the careful work done in all the emergency installations. This pump took suction from a hydrant with the top and valve removed to minimize friction loss.

One 2500 g.p.m. pump in barker building.

One 1200 g.p.m. pump in grinding building.

One 400-500 g.p.m. conveyor service pump (supplied one hose stream).

One 2500 g.p.m. service pump transferred to slasher building on Tuesday, May 2, supplying first a 2½-in. nozzle on an 8-inch pipe line and later three monitor nozzles.

One 1200 g.p.m. service pump located on town main discharging through 8-inch pipe to monitor nozzles. Put into service Saturday, May 8.

PUMPS FROM OUTSIDE SOURCES.

During Saturday, April 30, the Alcoa Power Co. offered the use of a pump with a rated capacity of 2000 g.p.m. against a 520 foot head. This pump with men and equipment arrived by special train at 6:00 A.M., May 1. This pump had not been in operation for a considerable time and a few minutes after starting at 3:00 P.M. a hot bearing developed. Repairs were made and on starting again the armature winding burned out. The motor was then taken to the plant shop for rewinding.

On Thursday, May 5, the necessary repairs were completed and this pump, located on a railway flat car approximately 150 feet north of the slasher building, was placed in service early Friday morning. This pump discharged through an 8-inch pipe with a 2½-inch sluicing nozzle and played directly against the burning face of the pile. The nozzle pressure for this pump was 165 lbs.

Looking northwest after the fire. The pile had covered this entire area. The bare ground shows the completeness of the burning.

At about noon Saturday, April 30, Price Brothers offered a belt driven centrifugal pump, rated capacity 2350 g.p.m., 80 foot head. This pump was considered of doubtful value due to low head. Therefore, a new impeller was installed which increased the capacity to 3300 g.p.m., 125 foot head. This work was completed and the pump left Riverbend for Port Alfred at about 7:00 P.M. the same day and was placed in service in the slasher building at 12:30 A.M., May 2, taking suction from the 16-inch wood stave pipe at 38 lbs. normal pressure.

All pumps were of the centrifugal pattern with direct connected motors except the last named which was belt driven.

In addition to these pumps from 12:30 A.M., Thursday, May 5, until after the fire was extinguished, the main pump of the suction dredge was continuously in service. It is understood that the rated capacity of this pump is 30,000 g.p.m. against practically no head. This pump discharged through a 24-inch pipe on the wood at an elevation of 85 to 100 feet above grade and from calculations it was determined the discharge was at the rate of 12,000 to 13,000 g.p.m.

OTHER EQUIPMENT USED.

One motor fire department pumper, having a rated capacity of 600 g.p.m., obtained from the municipality of Chicoutimi. This pumper operated continuously for 96 hours and was temporarily withdrawn due to blowing manifold gasket.

One motor pumper, rated capacity 350 g.p.m., obtained from the city of Quebec. This pumper operated continuously for 96 hours, and was temporarily withdrawn due to hot bearing.

A steam pumper, rated capacity 350 g.p.m., stated to be 62 years old, was obtained from the city of Quebec, operated 76 hours and was withdrawn and returned to Quebec due to burned out grates and tubes.

Hose and nozzles were obtained from various plants and municipalities and during the period of the fire 19,650 feet were in use. Only one or two blow-outs were recorded. A total of 4210 feet of pipe, 6, 8, 10 and 12-inch, was laid, all but 600 feet of which was taken from the plant. This does not include the 2000 feet of 24-inch discharge pipe from the dredge.

There were no interruptions to pumps, other than fire department pumpers, during entire period of fire except for the purpose of exchanging suction or discharge lines. A number of the plant's pumps totaling a rated capacity of 26,000 g.p.m. operated continuously, pumping directly on fire or supplying water to fire pumps.

Emergency Water Supplies.

It is probably safe to state that this plant was better equipped in the way of emergency water supplies than the average. These supplies, as previously indicated, consisted of a 6-inch connection from Port Alfred street mains to fire mains in the plant, 85 to 125 lbs. pressure, and 24-inch and 36-inch wood stave mains, fed by gravity from the Ha Ha River, two miles distant, with 38 lbs. normal pressure at the plant. The four emergency pumps installed in and adjacent to the slasher building took suction from a 16-inch branch of the 24-inch main. The 24 and 36-inch mains also supplied the two 6000 g.p.m. mill supply pumps which were connected in series and pumping into the fire mains. Two 6000 g.p.m., 150 feet head mill supply pumps also took suction from this same source and supplied water to mill supply mains from which the two 1000 g.p.m. fire pumps, a 2500 g.p.m. emergency pump, located on the first floor of the barker plant, and a 1200 g.p.m. emergency pump, located on the first floor of the grinder building, took suction.

Volume of Water Used.

Based on pressure reading taken at discharge outlets the volume of water delivered from hose streams, monitor nozzles open end pipes (including discharge from dredge),* on May 3, 5, 7, 8 and 9 was as follows:

Tuesday, May 3, period of 24 hours	21,532,320	Gallons
Thursday, May 5, period of 24 hours	44,626,040	"
Saturday, May 7, period of 24 hours	41,918,400	"
Sunday, May 8, period of 24 hours	45,930,240	"
Monday, May 9, period of 24 hours	47,071,680	"

Readings were not taken prior to Tuesday, May 3. However, delivery of water was gradually built up from the time of first stream, and beginning with the flank movement on east side on the night of Tuesday, May 3, and on west side Wednesday night, May 4, when hose lines were entered on inside

*NOTE: The suction dredge was placed in service 12:30 A.M., Thursday, May 5, delivering 12,000 to 13,000 gallons per minute.

face of the burning wings, the fire was being more contracted or followed up to the center or higher portion of the pile so that until the fire was considered definitely out at about 6:00 A.M., Wednesday, May 11, an increasingly greater proportion of this water was used in a small area.

Conclusions.

While pulpwood piles up to 100,000 cords and over are not unusual with Canadian mills, the pile at Port Alfred was of abnormal size, but with permanent protection above that for the average mill. This protection, however, was barely sufficient to retard the fire and could not control it. When abnormal emergency water supplies were made available at great expense, and primarily to save the mill, the fire in the pulpwood was extinguished. Such emergency water supplies cannot be expected for the average mill, and any attempted comparison for fire fighting between the large pile at Port Alfred and the ordinary pile of pulpwood is therefore futile.

The real lesson from the Port Alfred fire is the need for segregation of pulpwood storage into a number of small piles of moderate height and with ample clearance between the piles, and each pile surrounded by monitor nozzles and hydrants on large mains with an ample water supply of heavy pressure. As auxiliary, and to provide flexibility with large streams, there should be deluge sets and a number of 6-inch valved connections left in the underground to permit ready connection of large lines.

One or more emergency water supply of large volume, such as mill supply, should be provided at a point easily accessible to the wood pile. This supply should be provided with valved outlets to which emergency pump suctions could be connected and to which 6-inch or 8-inch connections can be made to extend up wood pile to flow on seat of fire at low pressure.

For mills having 20,000 to 25,000-cord piles, there should be available emergency pumping capacity sufficient to maintain not less than 175 lbs. nozzle pressure on two portable monitor nozzles 2½-inch diameter at tip. These pumps should take suction from an emergency supply. This will require a pumping capacity of 5000 g.p.m. and same should be in two units.*

It is an established fact that conveyor systems or stackers carry a considerable quantity of wood fluff, slivers, etc., into the wood pile and this matter is concentrated along the center line of the pile, extending practically from ground to peak of pile. The fire at Port Alfred advanced more rapidly in the center than at the sides. It is possible that this readily ignitable material can be considerably reduced if the bottom of the receiving end of conveyor trough is slatted at the point where wood is received.

*Where there are a number of mills located in a restricted area, it may be feasible to install this equipment on a special railway car, so that it may be quickly moved to the point of emergency. The cost of such equipment would be apportioned among the mills protected.

Where yard space will not permit multiplicity of piles, large piles should be divided by one or more fire walls, and the sizes of mains, the number of monitor nozzles and hydrants, 6-inch valved outlets and deluge sets increased accordingly. In case of fire in one section of pile, men with hose streams on top of the other sections should take care of the spark hazard judging by the recent experience at Port Alfred.

In practically every case where hose was brought in from other plants or cities, adapters had to be made before the hose could be used. Unless equipped with standard hose couplings, it is therefore recommended that each plant make up a sufficient number of adapters, fitting the hose used at any point which might be called on for assistance in case of emergency.

Adequate day and night watchmen should be provided for wood piles. This day and night watch service should apply even when the plant is in operation if the quantity of wood in yard cannot be clearly seen by the employees working on or around the pile. Where overhead conveyors are employed for stacking wood the watchman should patrol the bridge.

The top surface of wood piles should be kept wet down from early spring until late fall, even during the period when there are light frosts at night.

Detroit Pulpwood Fire.

Report by Western Factory Insurance Association, (Member N.F.P.A.).

Sparks from a cutting torch used on a conveyor above a large pulpwood log pile were presumably responsible for a fire which completely consumed the pile and partly destroyed the conveyor at the plant of the Detroit Sulphite Pulp and Paper Co., at Detroit, Michigan, on April 27, 1932. This fire clearly demonstrates the need of properly distributed monitor nozzles with ample water supplies, making possible a concentration of large caliber streams during the early stages of a fire in a pulpwood pile. It also illustrates the ineffectiveness of large volumes of water after the fire has attained considerable headway in the pile.

Description of the Property.

The log pile which was involved in the fire was the principal storage pile of the company and was located in the yard approximately 150 feet southeast of the main buildings of the plant. The mill buildings, for the most part of brick exterior construction, were not involved in the fire except for wooden roof structures or passageways which were ignited by flying sparks.

At the time of the fire the log pile was about 425 feet long, 200 feet wide and 80 feet high, containing about 16,000 cords of peeled and rough spruce. This pile began about 125 feet northwest of the slasher building

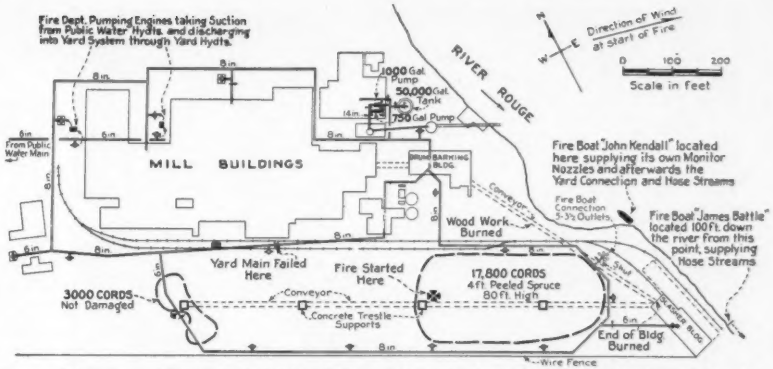

Fire Dept. Pumping Engines taking Suction from Public Water Hydts. and discharging into Yard System through Yard Hydts.
Direction of Wind at Start of Fire
Scale in Feet
RIVER ROUGE
1000 Gal. Pump
50,000 Gal. Tank
750 Gal Pump
MILL BUILDINGS
Fire Boat "John Kendall" located here supplying its own Monitor Nozzles and afterwards the Yard Connection and Hose Streams
Fire Boat Connection 5-3½ Outlets
Fire Boat "James Battle" located 100 Ft. down the river from this point, supplying Hose Streams
Wood Work Burned
Yard Main Failed Here
Fire Started Here
17,800 CORDS 4 ft Peeled Spruce 80 Ft. High
3000 CORDS Not Damaged
Conveyor
Concrete Trestle Supports
End of Bldg Burned
Wire Fence

Diagram of Detroit Sulphite & Paper Co. plant, Detroit, showing location of pulpwood pile involved in fire of April 27, 1932.

located on the river bank. Traversing through the center, about ten feet above the crest of the pile, was a cable conveyor supported on steel and concrete piers that carried the logs from the slasher building to the desired points of storage. This conveyor was partly destroyed and the frame slasher building was damaged by the fire.

Fire Protection.

All important parts of the mill group are sprinklered, including the frame slasher building, which was damaged. An 8-in. loop main extended around the log pile, having eleven two-way hydrants spaced from 120 to 230 feet apart. There was 2000 feet of $2\frac{1}{2}$-in. hose on reels or in convenient hose houses, with the usual supply of auxiliary tools and equipment. A private fire brigade of twelve men was maintained.

Sprinklers and yard hydrants are supplied by a 50,000-gallon gravity tank on a steel tower and by two fire pumps of 1000 and 750 gallons capacity taking suction from the river. Fireboats can also pump into yard mains through a five-way header. In addition to the yard hydrant systems, two city hydrants from a 6-in. public main extend into the plant yard.

Story of the Fire.

The fire was discovered at about 3:30 P.M. on Wednesday, April 27, when the yard foreman observed smoke coming from the top of the pile. He immediately notified the plant telephone operator, who in turn notified the watchman at the main gate house. A city fire alarm box was provided in the gate house and the alarm to the fire department was transmitted from this point.

Pending the arrival of the fire department, employees dragged two lines of $2\frac{1}{2}$-in. hose from the nearest yard hydrant to the seat of the fire at the top of the pile. These two $1\frac{1}{8}$-in. streams were supplied by the gravity tank for a few minutes until the fire pumps could be put into operation. These streams

Factory Mutual Record.

The Detroit pile was only one-twelfth the size of the one at Port Alfred. Note how fire spread over the entire pile in contrast to Port Alfred, where, by effective use of ample water supplies, the fire was confined to a single front.

apparently had but little effect on the fire, which seemed to break out at different places after being put out on the surface.

The first alarm to the fire department brought three 750-gallon pumpers and a fireboat, the latter arriving about fifteen minutes after the pumpers. The first pumper to arrive connected to the city hydrant in the north end of the yard and pumped into the sprinkler yard mains through a private yard hydrant. The other two took suction from private yard hydrants adjacent to the burning pile. Two lines with 1½-in. nozzles were stretched to the top of the pile and two others were used to wet down the pile in advance of the spread of the fire. When the fireboat *John Kendall* arrived, a 4-in. stream from the monitor nozzle on the pilot house was brought into play to wet down the logs as far as possible. Owing to the distance, the stream, while not entirely wasted, failed to reach the fire at the top center of the pile. Hose lines were stretched from the fireboat, four to a turret nozzle with a 2½-in. tip on a hose wagon, three to the log pile with 1½-in. nozzles and one 3½-in. line was connected to the yard main.

After about an hour, when the firemen thought they had the fire under control, it broke out simultaneously in several places throughout the pile. A second alarm was sounded at 4:55 P.M., followed by additional calls for more equipment until by 7:00 P.M. ten more pumpers and the fireboat *James Battle* had joined the units responding on the original alarm. Five of these pumpers took suction from the river or drain basins, four took suction from the yard mains and one pumped from a city hydrant to the yard main. The fireboat *James Battle* took a position 400 feet down river from the *Kendall* and supplied five hose lines along the south side of the pile.

Fanned by a 15-mile wind, the fire continued to spread rapidly, enveloping the pile nearly from end to end. The fire was most intense at the south and west sides, where the pile was blazing from the ground to the crest. The heat and smoke forced the firemen to withdraw to lower levels on the east side, where, because of favorable wind direction, they were still able to use their streams, but they could only reach the edges of the burning logs. Firemen remained on the top of the pile, however, until it was apparent that the steel work of the log conveyor above was in danger of collapse, which it did shortly after they retreated.

As the firemen retreated to the ground level they realized the ineffectiveness of their hose streams applied from this point, due to the height they had to reach against the stiff wind that broke the streams. Little if any water reached the top strata where the fire was most intense, but dissipated itself in steam or fine spray. The firemen therefore decided to concentrate their efforts to drenching the wall of logs along the east (mill) side and fight back the fire so the plant would not be endangered. This appears to have been good judgment.

Keystone-Underwood.

The fire at the top of the Detroit pulpwood pile was entirely out of reach of the hose streams used from the ground and from the fireboat.

The intense heat at the south end of the pile ignited the frame walls of the slasher building, and sparks ignited fencing and structures on the adjoining wharf. These fires were controlled by employees using chemical extinguishers and by firemen with hose streams.

About two hours after the fire started the south span of the overhead steel log conveyor collapsed, pulling away part of the slasher building and breaking off the 2½-in. sprinkler main in the north end of the building. This break, together with twenty-seven sprinkler heads opened by employees, caused considerable waste of water until the post indicator valve was shut, three or four hours later. The log conveyor from the slasher building to the barker building was on fire several times, and the radiated heat ignited the wooden catwalk and side of the log trough. Hose streams directed on the structure prevented serious damage, however.

The fire apparently reached its maximum intensity about midnight, Wednesday the 27th, gradually diminishing as the charred fuel settled and the firemen were able to get into closer range with hose streams. Thursday morning, April 28, the wind shifted, blowing directly from the south and southwest, carrying great volumes of smoke into the plant, resulting in its shutting down.

As the logs were consumed at the core of the pile, arching apparently took place, followed by periodic breaks and collapse of the pile. This caused great showers of sparks and brands which were carried away by the wind. For a time no harm was done by these brands other than to ignite ground bark in the vacant yard to the west and south, but a real menace appeared at the period when the wind changed and the sparks and brands, falling on mill roofs, caused small fires in frame roof houses and passageways, which had to be extinguished by small hose streams in the hands of company employees.

The fire was really not brought under control until the following Friday evening, and continued to burn and smoulder until Tuesday, May 3rd, or a total of approximately 152 hours.

Operations of Fire Department.

When the fire was at its greatest intensity the fire department estimates that twenty-nine hose streams were in action, supplied by fire department pumpers, fireboats and private mill fire pumps. At one period the fireboat *Kendall* also had two 3½-in. lines into the header delivering to yard mains. Some of these streams were from turret nozzles mounted on high pressure hose wagons being supplied from three or four lines siamesed. Nozzle sizes varied from 1⅛-in. to 1½-in. for hand lines and from 2-in. to 4-in. for turret nozzles on fire apparatus and fireboats.

It is estimated that the amount of water used when the fire was at its greatest intensity was between 21,000 and 23,000 gallons per minute, 15,000 gallons of this being supplied by the fireboats. The draft of water by pumpers,

coupled with the operation of the sprinklers in the slasher building, overtaxed the private mill protection so that the gravity tank was emptied and the pumps could maintain but 50 to 60 pounds pressure on the yard mains.

At 7:45 P.M., Friday, an 8-in. sprinkler underground main failed, due to excessive pressure from the fireboat when several pumpers were shut down. The break was repaired some three hours later, but when pressure was put into the system it was found that the bell end of a length of cast-iron pipe about twelve feet ahead of the first break was cracked, necessitating further repairs which were not completed until 1:45 P.M. the following day. During the interval, while repairs were being made, all sprinkler protection was shut off the entire plant and all private yard hydrants were out of service. Firemen and employees patrolled the inside of the buildings during this period.

Cause of Fire.

The cause of the fire may, with reasonable certainty, be attributed to sparks from an acetylene torch which was being used by a repair gang on the overhead conveyor passing directly over the log pile. While the actual repair work at the moment the fire was discovered was not directly over the log pile, such work had been done over the log pile a short time before. As no precautions had been taken to prevent sparks from falling into the pulpwood, it is quite possible that the fire may have started from this source and been smouldering beneath the surface some time prior to its discovery.

Damage.

The log pile, estimated at about 16,000 cords, was nearly a total loss, amounting to approximately $200,000. The main overhead log conveyor was about half destroyed. The loss to the slasher building and to the conveyor leading to the barker building was estimated at about $15,000.

Fire Record of Pulpwood Piles.

As a result of the interest created by the recent large losses in pulpwood piles at Detroit, Michigan, and Port Alfred, Quebec, a fire record covering fire experience in eighty-one pulpwood fires has been prepared. Like other N.F.P.A. fire records this record may be incomplete in that many small fires may not have been reported. It is, however, of sufficient scope that reasonable deductions can be drawn.

The number of fires involving losses of under $1000 and of over $1000 were about equally divided. There were 35 fires where the loss was less than $1000 and thirty where the loss was greater than this figure. In the latter class there were eight fires where piles were totally destroyed. To the fires of known loss should be added sixteen fires where the loss was not determined.

Weather conditions naturally are a factor in log pile fires and the greatest number may obviously be expected in the summer months. Sixty-three fires occurred in the period from April to September inclusive, fifteen from October to March, and three occurred at a period not stated in the report. The wind factor was checked on the 30 fires involving losses of $1000 or more with the following result: Strong 14, light 7, moderate 3, and unknown 6.

The causes of the fires studied were as follows:

Causes of Fire.

Sparks from stack or locomotive		24
Exposure from other fires		19
Use of dynamite to break up frozen piles		8
Careless smoking		7
Incendiarism		3
Miscellaneous causes		20
Friction (on conveyor)	4	
Electrical (on conveyor)	6	
Sparks from acetylene torch	2	
Other causes	8	
Total		81

Detailed information as to the methods of extinguishment were available for fifty-nine fires included in the records, as indicated by the following table:

Method of Extinguishment.

Monitor nozzles		16
Used alone	2	
Controlled fire and hose streams extinguished fire	9	
Not effective—out of range	4	
Not effective—due to wind	1	
Hose streams		43
Used alone—loss less than $1000	29	
Used alone—loss more than $1000	14	
Data incomplete		22
Total fires		81

In connection with the extinguishment of fires it is interesting to note that the average number of streams employed was seven. In eighteen fires hose lines were carried up on the pile and the fire fought at close range. In eight instances the surface wood was removed as the fire progressed and the fire was followed down into the pile.

For the purposes of more detailed analysis the fires in this record have been divided into four groups—fires not controlled; fires controlled by use of monitor nozzles, hose streams and deluge sets; fires controlled by hose streams, effectively applied, with small loss; and fires in small piles involving but moderate loss. Typical fires in each group have been included in some detail.

Fires Not Controlled.

There were fifteen fires that were not controlled, involving an aggregate loss of $5,622,029. (This figure includes the $2,500,000 Port Alfred fire of April 29, 1932, discussed in detail on page 63 of this QUARTERLY.) The quantities of wood involved in these fires ranged from a minimum pile containing 4000 cords to a maximum pile of 221,000 cords. The average pile contained from 10,000 to 20,000 cords.

The loss of wood averaged about 89 per cent of the total involved and with two exceptions (50% and 39%) the loss was over 80 per cent in every case. In two fires adjacent lumber piles were destroyed, in two others mill buildings were seriously involved. Conveyors were badly damaged in two instances and completely destroyed in another. Six of these fires started at the top of the pile.

Hose streams including deluge sets were used in extinguishing nine fires, hose streams and monitor nozzles were used twice, hose streams from forest fire pumps were the only fire protection available in one instance, while in three fires no protection was available.

The contributing factors in the large losses in these fifteen fires which were not controlled were:

Inadequate protection	8
Time taken to apply water	5
Excess size of pile plus time to apply water	1
Forest fire and high wind	1

The fires in this group demonstrate that unless powerful water supplies can be delivered directly on a fire at or near the point of origin within ten minutes or less the subsequent application of even larger volumes of water at long range will prove nearly useless. The ineffectiveness of the large and powerful hose streams applied by a well-trained fire department in the case of the Detroit Sulphite Paper Co. fire (see page 80 of this QUARTERLY) is indicative of how totally ineffective limited water supplies would be in isolated locations, with but meager outside facilities available.

Typical Fires Not Controlled.

JUNE 7, 1923, PORT ALFRED, P. Q. This fire apparently started at noontime near the center of the top of a 17,000 cord pulpwood pile. The wood was very dry, and it is probable that sparks from a locomotive ignited loose dry bark on the pile. The alarm was given promptly, three lines of hose were immediately laid up on the pile and the fire pump started.

In a short time all visible fire had been extinguished, but smoke continued to issue from the pile, indicating that the fire had worked its way in. Two more streams were added and additional men were called to remove logs from the top of the pile in an effort to reach the fire. The smoke increased in volume, however, and the men had to be gradually withdrawn. Additional

Factory Mutual Record.

The fire at Washburn, Maine, indicates the need of adequate fire fighting equipment at the start of the fire. Three pulpwood piles containing 34,000 cords of wood were totally destroyed.

streams were brought into use and assistance summoned from outside the plant, but at 5:00 A.M. the next morning flames issued from the pile and it was apparent that the pile was doomed. The entire pile was destroyed together with the conveyor, involving a loss of $168,300.

This loss may be attributed to inadequate protection although the available equipment and water supplies were apparently intelligently employed. The total pumping capacity was but 1500 gallons per minute, obviously inadequate for a pile of this size, and no monitor nozzles were provided. (S-35002.)

JUNE 16, 1925, WASHBURN, MAINE. Fire broke out in a shingle mill across the river from where 34,000 cords of pulpwood was stored. The wood had been piled two years and was very dry. It was in three piles,—one of 6000 cords, another fifty feet away of 13,500 cords, and a third, with the base touching the second, of 14,500 cords.

Shortly after the fire started sparks ignited the smaller pile. Two gasoline-driven portable forest fire pumps were immediately put into service supplying two small streams which were carried up on the pile, but were entirely inadequate. Fifteen minutes after the fire was discovered a fire department pumper arrived from a near-by town, but by this time the fire had spread to the second pile, and soon to the third pile. Three more pumpers arrived within ten minutes and a maximum of twelve hose streams was used in fighting the fire. These streams had but little effect and the three piles were totally destroyed together with about 500,000 feet of sawed lumber stored near by. The fire raged for 72 hours and caused a loss estimated at $600,000.

This fire not only indicates the need of adequate protection immediately available, but demonstrates the ease and rapidity with which an unprotected pile can ignite from an exposure fire at considerable distance. (S-40490.)

FEBRUARY 17, 1932, BROMPTONVILLE, P. Q. The elapsed time between the start of the fire and the application of water was responsible for the total loss of an 18,000-cord pile of pulpwood, in spite of the fact that the pile was covered with snow at the peak, and on the side where the wood was being reclaimed. At the peak, beneath the conveyor, there was probably an accumulation of bark, splinters and wood refuse which was dry enough to ignite readily from a spark from the stack.

The fire was discovered by someone in town who telephoned the mill. The alarm was blown on the mill whistle, the fire brigade quickly assembled, and the 1500-gallon fire pump was started. A line of hose with $1\frac{1}{8}$-inch nozzle, already laid on the pile for use in dislodging wood, was in service within five minutes. Two more hose streams were added within fifteen minutes, and a total of six were playing on the fire within a half hour.

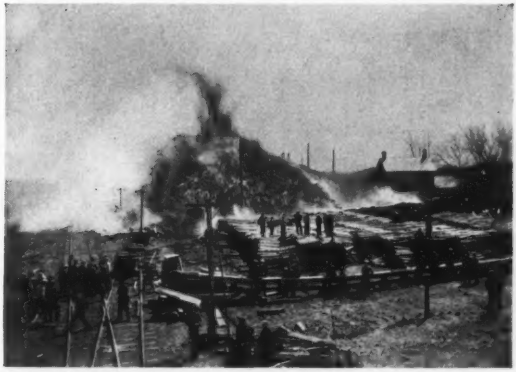
The fire had apparently progressed far enough before it was discovered to allow glowing embers to drop down into the pile. As a result, although the first hose streams were applied soon after the alarm was given, and although they extinguished all visible flame on the surface in an hour, yet the streams could not reach the fire which was burrowing below the surface. Large-size monitor nozzles had been provided, but the peak of the pile where this fire happened to start was out of range of these streams.

During the afternoon the six hose streams, supplied by the 1500-gallon fire pump, a 430-gallon fire pump, and a 100,000 gallon tank, were kept playing on the fire. All this time the fire was working farther down into the pile. At seven o'clock, a section of the top of the pile slid down and exposed a deep-rooted fire. For another hour and a half the hose streams continued to be used, and it seemed that the fire might be controlled. Then the wind shifted suddenly to the west, increased in velocity to almost gale force, and started to drive the fire back into the pile.

From then on it appeared that the pile was doomed and fifteen hours after the start, the fire had consumed practically the entire pile, except for a few hundred cords at the edges which hose streams and monitor nozzles succeeded in protecting. The large fire pump ran continuously for 48 hours, the small pump for 46 hours, and the total amount of water used is estimated at $5\frac{1}{4}$ million gallons. The loss was estimated to be over $200,000. (H-34652.)

APRIL 22, 1932, CAMPBELLFORD, ONTARIO. Two fires occurring at the same plant within a day of each other furnish simultaneously an example of a fire controlled by prompt use of hose streams and an instance of a fire not controlled due to inadequate fire-fighting equipment.

Wood was stored in two piles, one containing 2500 and the other 7500 cords. A bark burner was located in a 100-foot space between these two piles. On April 22, this burner apparently threw off sparks which started a fire at the top of the smaller pile. Fortunately workmen discovered the blaze



Factory Mutual Record.

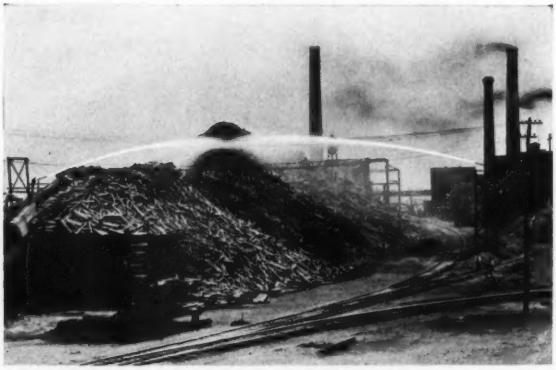
The only protection for this log pile at Campbellford, Ontario, was a hydrant 500 feet distant. Fifteen minutes were required to get water on this fire, which was driven into the pile by a strong wind. The pile was destroyed.

promptly and got three hose streams from near-by hydrants into action soon enough to extinguish the fire before it burrowed down into the pile. A section of wooden conveyor and about 100 cords of wood were destroyed.

At noon the next day another fire was discovered in dry grass at the far end of the larger pile, 500 feet away from the nearest hydrant. It is thought to have been started by boys. Fifteen minutes were needed to lay hose, and in the meantime a steady wind drove the fire into the pile. Mill-use pumps were started, but they were limited in capacity and pressure, and the friction loss in long hose lines further reduced the effectiveness of the streams. Three small portable gasoline pumps used for forest fires were obtained, and at ten o'clock that evening a pumper of the horse-drawn type arrived from Peterboro on a railroad flat car. Nine small streams, mostly 1-inch, were finally in use, but the fire was far beyond control, and all efforts were concentrated on protecting the small pile, which was saved. Practically the entire large pile was destroyed with a loss estimated to be between $75,000 and $100,000. (H-34923.)

Fires Controlled by Use of Monitor Nozzles and Hose Streams.

The fires controlled by use of monitor nozzles, hose streams and deluge sets and those controlled with small loss by hose streams effectively applied, have, for the purpose of this record, been classified in a single group. Of the twenty-three fires listed in this group the outstanding reason for extinguishment with small or moderate loss was the prompt application of water. The value of monitor nozzles, close-range fire fighting with hose streams and removal of surface wood in order to get at the seat of the fire is clearly shown. This latter method of fighting log pile fires, although successfully carried out



Factory Mutual Record.

Fire starting fifty feet above ground in this 16,000-cord log pile at Mechanicsville, N. Y., was quickly extinguished with slight loss by use of monitor nozzles.

by trained private fire brigades in several instances, is apparently not generally practiced.

The losses in the fires in this group were, for the most part, moderate and with one exception did not exceed $6800. Most of them were less than $1000. The size of the piles involved varied considerably, but generally ranged from 10,000 to 20,000 cords. Four were more than 20,000 cords, two of which were over 10,000 cords. Only one fire involved more than 600 cords and the majority involved less than 100 cords.

Monitor nozzles, hose streams and deluge sets were used to extinguish twelve fires and in five of these fires the hose streams were taken on to the pile. In two cases successful attempts were made to follow the fire into the pile. In each of these twelve fires water was promptly applied within a few minutes of the start and discovery of the fire, six of which originated at the top of the pile.

Hose streams alone, effectively applied, were factors in eleven fires which were extinguished with small or moderate losses. In all but two of these fires water was promptly applied. In the two exceptions delays were occasioned by the necessity of laying long lines from a distant hydrant, and in one case operations were further complicated by the fact that the tank by-pass was open.

Typical Fires Effectively Controlled by Monitor Nozzles and Hose Streams.

JUNE 20, 1924, MECHANICSVILLE, N. Y. Fire was discovered about fifty feet above the ground on a log pile containing about 16,000 cords of unbarked pulpwood. The wood had been piled all winter and after the covering of snow had melted, the pile had been wet down daily in dry weather. A spark from a switching engine is supposed to have lodged in loose dry chips and started the fire, which when discovered involved an area about ten feet square.

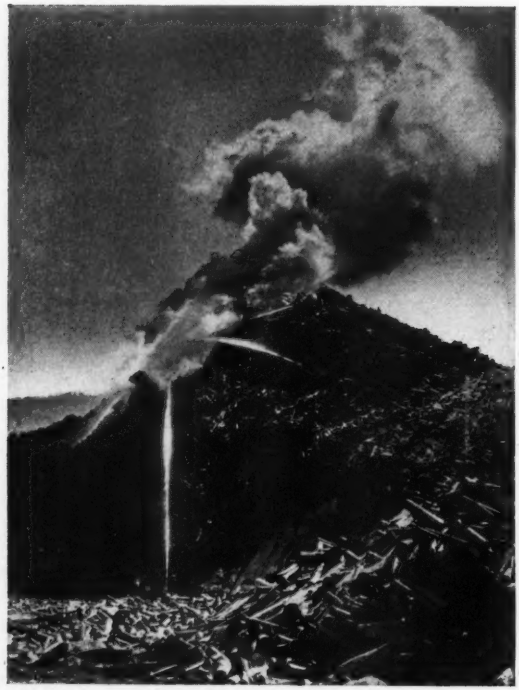
The log piles at this plant were protected by monitor nozzles spaced at frequent intervals around the base of the piles, so that streams would reach any point on the surface. When the fire was discovered, the nearest monitor nozzle was turned on by one of the yard men, and it extinguished the fire in less than a minute. This nozzle was supplied by city water, but as a matter of precaution the fire pump was started, and the two adjoining nozzles were turned on, although they were not needed. The mill management believed that if it had been necessary to delay long enough to lay hose, the fire would have become a serious one. As it was, the damage to the wood was so small that no claim was made. (S-38061.)

APRIL 11, 1926, BERLIN, N. H. Efforts were being made to use up the old pulpwood before the new river-driven wood was received in the spring. The pile, originally larger, contained 12,000 cords of barked spruce at one end of the log pond. Where the wood had been taken away on the pond side, the pile was steep and in places perpendicular. The other side had its original natural slope, extending from the ground to the peak 100 feet high. The log-yard watchman discovered the smoke coming from the steep side of the pile about 70 feet above the level of the log pond. Flame followed the smoke almost immediately and began to spread rapidly, driven by a strong wind. The watchman at once summoned the private fire brigade. He then turned on the water to the monitor nozzle nearest the fire. From where the watchman was standing the fire could not be seen, because it was on the other steep side of the pile, under an overhanging projection. The stream he was using had to be shot up over the pile, and he had no way of knowing whether it was falling effectively on the other side. When help arrived, a line of hose was attached to the monitor nozzle and carried up a runway which was conveniently located at that point.

The monitor nozzles had been located to protect the full pile. Now that the pile had become smaller, some of them were too far away; the others which were nearer the pile were on the side away from the fire, which was just out of range over the crest. Therefore none of the monitor nozzles could be used directly.

Two more hose lines were run from a near-by hydrant. Because there were no other hydrants available, the remaining lines, five in number, were connected to monitor nozzles, which really performed the functions of hydrants. Three of the streams thus made available were used against the steep face of the pile, and the other five were carried over the top and sides to form a ring around the fire, thus holding it in one spot. The fire was extinguished two hours after it started.

Since workmen had been using dynamite fired by a fuse to loosen the wood which was frozen in the pile, it is logical to suppose that this fuse was the cause of the fire. The location where the fire started is said to have been



Factory Mutual Record.

Quick and efficient action of the mill fire brigade, backed by an ample water supply, kept the loss from this Berlin, N. H., fire down to a few hundred dollars. Out of range of monitor nozzles and difficult of access, this fire was controlled by the intelligent use of hose streams.

about under the line of a temporary sluice used during piling. It is probable that a pocket of fine bark at this point furnished conditions favorable to a smouldering fire breaking into flame. Because of its location high on the side of the pile, this fire was difficult of access and gave promise of quickly extending beyond control. Quick work and good organization soon controlled the fire, with a loss of about $225. (S-42046.)

NOVEMBER 15, 1928, WESTBROOK, MAINE. A fire, probably caused by careless smoking, originated at the land end of a conveyor operating on a pulpwood pile containing 13,000 cords of wood. The mill fire department responded promptly, laying two lines of hose from near-by hydrants and putting two monitor nozzles into operation. The fire was extinguished in thirty-five minutes and the damage was confined to the land end of the conveyor, the conveyor house and about four cords of pulpwood. The loss was estimated at $700. (S-49424.)

APRIL 16, 1931, HULL, QUEBEC. A fire starting on the top of a pulpwood pile containing 22,500 cords of wood was promptly extinguished by one stream from a monitor nozzle, a hose stream from the standpipe on the conveyor and a hose steam from a mill yard hydrant. The loss was small due to the prompt action of the plant employees in attacking the fire and preventing its penetration below the surface of the pile. (S-58331.)

Typical Fires Controlled by Hose Streams Alone.

JUNE 27, 1927, RIVERBEND, QUEBEC. A fire, caused by friction on the conveyor, destroyed 45 cords of wood at the top of a 78,000 cord pulpwood pile. The height of the pile was 110 feet and the area about 800 by 320 feet. Streams from the three monitor nozzles provided on the north side could not reach the fire on account of the height of the pile and hose streams were taken up the pile by the fire brigade.

Seven lines of hose were carried up the pile to fight the fire at close range and three were placed in service at the grade level to wet down the pile. The fire worked its way into the pile, but was brought under control and extinguished with a loss of approximately $800. (S-45701.)

DECEMBER 8, 1931, KAPUSKASING, ONTARIO. About 11:00 P.M., three charges of dynamite, which had been fastened to a stick and shoved into the pile at a point about 25 feet below the peak of a 13,000 cord pile, were fired. Twenty minutes later, smoke was noticed coming from the pile and a high wind, estimated at more than 30 miles an hour, was driving the fire into the peak with great rapidity.

The streams from the monitor nozzles were not effective because the high wind blowing across them broke the streams into spray which did not reach the fire, but covered the logs with ice, making the handling of hose lines difficult. It was midnight before the first hose stream was directed onto the fire; and shortly afterward, two more were in use at the top of the pile. A deluge set, supplied by two lines of hose was taken up on the pile, but could not be handled successfully with high water pressure on account of ice on the logs. The tip was changed from 2-inch to $1\frac{3}{4}$-inch, and the deluge set was relocated with the wind directly behind it, which forced the stream into the pile.

By one o'clock it was evident that the fire had commenced to work its way down into the pile, and this became a critical time in the fight. The hose nozzles were then moved close up to the seat of the fire in order to bring effective streams to bear. This, combined with the frozen spray which coated the pile and probably served to cut off the air supply, enabled the fire to be brought definitely under control at 3:00 A.M. The last vestige of the fire had been extinguished at 7:00 A.M. Although the fire was a stubborn one to fight due to its location, the high wind, and the low temperature, the amount of wood damaged or consumed was only about 200 cords. The loss was estimated at $2000. (H-35400.)

Other Fires.

The remainder of the fires included in the fire record, forty-three in number, occurred in small piles and while of interest from a statistical viewpoint were not of value for the purposes of analysis. In many instances the reports were not sufficiently detailed to permit exact analysis of the various factors involved.

The maximum loss in any one fire in this group was $25,800, nine involved losses of over $1000, and 34 had reported losses of less than $1000. There were only five piles in this group containing more than 10,000 cords, and the greatest number of cords burned in a single fire was 1300. Thirty-three of the forty-three fires in this group involved less than ten cords burned.

Prevention and Control of Pulpwood Pile Fires.

1. Prevent fires from starting. Most of the fires in this record were preventable. The spark hazard exists even in winter. Maintain spark-arresters for locomotives and for stacks of wood-burning boilers, in good condition. Keep log yards clean and eliminate wooden motor-houses and other shanties. Use drag rigs to free logs, instead of dynamite. Slatted sections of conveyor-trough may be provided in conjunction with a high pressure spray system as a possible means of eliminating combustible chips and bark. Stacked piles should be wet down daily during dry weather and smoking should be eliminated in the vicinity of the piles.

2. If fire starts, it should be attacked promptly before embers drop too far down into the pile. It must be controlled by strong streams at the very start. Speed and plenty of water are both necessary. Monitor nozzles if properly located fulfill these needs. One man can turn a powerful stream from a monitor nozzle on a fire at once, while a crew of men and considerable time are needed to lay hose streams. Hydrants connected to ample size mains, plenty of hose, and portable Siamese deluge-nozzles are needed to supplement the monitor nozzles, and for close range fire fighting.

3. If a fire is not completely extinguished in a reasonable time, it must if possible be followed down into the pile. This inyolves vigorous work by a large crew of men, using hose streams at close range and throwing the logs back in order to reach the very seat of the fire.

4. To prevent a large loss in case a fire gets out of control, piles should be limited to 20,000 cords. They should be not over 200 feet wide so that monitor nozzles can be laid out to give at least two powerful streams at any point on the pile. A clear space of 100 feet should be provided between individual piles and between piles and buildings. To fight a log-pile fire and at the same time protect adjoining piles and near-by buildings will require a pumping capacity of at least 5000 g.p.m. at good pressure.

5. Store wood when possible by close piling or ranking instead of by stacking.

Fires in Which There Was Loss of Life.

Since the publication of the April QUARTERLY, the N.F.P.A. Department of Fire Record has received from various sources 167 reports of fires in which loss of life has occurred. While the number of fires reported to the N.F.P.A. is but a small fraction of the total number that have occurred during this period, the volume of data is sufficient to indicate the predominating causes of loss of life. A total of 324 lives were lost in the fires included in this tabulation.

During the period covered by this record three outstanding loss of life fires have occurred, exacting a toll of fifty lives. Reports of these fires appear in other portions of this QUARTERLY. Two of these disasters, the Ohio State Office Building explosion at Columbus on April 14, 1932, with a loss of ten lives, and the Ellington Apartment fire in Cleveland on June 7, 1932, with a loss of twelve lives, occurred in Ohio. The third of these major disasters was the explosion involving a dry dock and the tanker *Cymbeline* at Montreal, P. Q., on June 17, 1932, with a loss of thirty lives.

Loss of Life Fires, April-June, 1932.

This is a typical rather than a complete record, presented to show the conditions under which loss of life occurs, that they may be known and guarded against. The total loss of life by fire in the United States is estimated at 10,000 annually.

Class of Fire	No. Fires	Lives Lost. Men	Women	Children	Total
Airplane fires	4	8	0	0	8
Apartments, hotels, lodgings, tenements, etc.	14	12	14	13	39
Automobile fires	9	13	5	3	21
Buildings under construction	1	10	0	0	10
Churches	1	0	0	3	3
Dwellings—Rural	43	14	25	42	81
Dwellings—Urban	36	19	18	8	45
Gasoline tank truck	1	2	0	1	3
Grain elevator	1	1	0	0	1
Industrial occupancies	5	5	0	0	5
Mining property	2	12	0	0	12
Multiple occupancy	7	6	3	6	15
Oil refineries	1	2	0	0	2
Other buildings	14	11	1	9	21
Other than buildings	9	6	1	3	10
Pier fires	1	1	0	0	1
Response to alarms	7	8	0	0	8
Schools and universities	2	3	0	0	3
Ships and boats	4	4	0	0	4
Tank steamer	2	31	0	0	31
No data	3	3	0	0	3
Total	167	171	67	88	326

This table is made up from reports received by the Department of Fire Record between April 1 and June 30, 1932. A few of the fires included herein occurred prior to April 1, but were not reported until after that date.

One outstanding tragedy took place outside of this continent when the new 16,900-ton French motorship *Georges Phillipar,* returning to Marseilles from her maiden voyage to the Far East, was destroyed by a fire in the Red Sea. The fire started in a stateroom in the first class cabin and, although promptly discovered, spread rapidly. Authentic details as to loss of life are lacking, but at least fifty persons are thought to have perished. The reason for the rapid spread of the flames, in spite of prompt discovery of the fire, is generally attributed to the light combustible construction.

Causes of Loss of Life, April-June, 1932.

Fatalities classified according to the immediate causes of the loss of life rather than according to the cause of the fire.

Cause	Men	Women	Children	Total
Airplane fires	8	0	0	8
Automobile fires	13	5	3	21
Children alone in house	0	0	10	10
Children and matches	0	0	8	8
Cleaning with gasoline	0	5	0	5
Clothing ignited—bonfire	0	1	0	1
Clothing ignited—fireplace	1	0	1	2
Clothing ignited—scrap film fire	1	0	0	1
Clothing ignited—smoking	3	0	0	3
Clothing ignited—stove or heater	1	7	2	10
Clothing ignited—rolled into fire while asleep	1	0	0	1
Explosion—asphalt tank	2	0	0	2
Explosion—blasting powder	2	0	4	6
Explosion—grain dust	1	0	0	1
Explosion—home-made dynamite	1	0	0	1
Explosion—home-made oil burner	1	1	2	4
Explosion—illuminating gas	20	0	1	21
Explosion—kerosene lamp	0	1	0	1
Explosion—mine	10	0	0	10
Explosion—powdered milk plant	1	0	0	1
Explosion—refrigerating plant	1	0	0	1
Explosion—supposed incendiary origin	7	12	3	22
Explosion—tank steamer	31	0	0	31
Explosion—unknown on barge	1	0	0	1
Fire fighting	4	0	0	4
Fireworks	0	0	1	1
Forest fire fighting	2	0	0	2
Gasoline tank truck crash	2	0	1	3
Gasoline used to start fire	5	3	0	8
Hot stones to warm bed	1	0	0	1
Ignition of flammable liquids or vapors	2	0	9	11
Ignition of nitrocellulose materials	2	0	0	2
Kerosene used to start fire	0	4	2	6
Overcome by smoke—suffocation	8	9	10	27
Overexertion—excitement	1	0	0	1
Re-entering burning buildings	1	3	0	4
Response to alarms	8	4	0	12
Smoking in bed	2	2	0	4
Spectator at fire struck by hose coupling	1	0	0	1
Traffic accident at fire	1	0	0	1
Trapped in burning buildings	22	9	31	62
No data	3	1	0	4
Total	171	67	88	326

Typical Loss of Life Fires.

Children and Matches.

L-1609. MONTREAL, P. Q., APRIL 20, 1932. A four-year-old boy died in a hospital of burns about the face, hands and legs which he received while playing with matches. His mother, who was working in the yard, saw a curtain afire in one of the rooms, ran inside and found the clothing of the child ablaze.

L-1577. CENTRAL FALLS, R. I., MAY 22, 1932. A five-year-old girl, while unattended, emptied the contents of a large box of matches on the piazza floor to play with them. The matches ignited the child's nightdress. The victim's father heard her screams and beat out the flames. She was taken to a hospital, where she died a few hours later.

L-1657. CAMBRIDGE, MASS., JUNE 19, 1932. A four-year-old girl died at a hospital of burns received when her clothing caught fire at her home. She was playing with matches.

Clothing Ignited from Stove.

L-1612. HILLSGROVE, R. I., APRIL 16, 1932. Heroic efforts of her blind husband, who with his hands attempted to beat out the flames which enveloped his wife, failed to prevent fatal burns when an elderly woman's clothing became ignited while she was preparing breakfast.

L-1611. TRENTON, N. J., APRIL 16, 1932. A woman received fatal burns when her clothing ignited from a stove in her home. She was taken to a hospital, where she succumbed to her injuries.

L-1610. PLAINFIELD, N. J., APRIL 18, 1932. An eighty-year-old woman was fatally burned in the kitchen of her home when her dress ignited from the gas range. A neighbor who heard her cries summoned a physician, but the woman died within a short time.

L-1608. BOSTON, MASS., APRIL 21, 1932. A woman died in a hospital of burns received when her clothing caught fire from the stove as she was preparing luncheon. After beating out the flames she called policemen, firemen and her son by telephone.

L-1603. EDGEWATER, N. J., APRIL 27, 1932. An eighty-four-year-old woman died in a hospital a few hours after her clothes were ignited by a gas stove in her home. A small boy outside saw the flames and called neighbors who extinguished the fire. The fire department was called and the victim's son drove the first piece of apparatus to arrive.

Fireworks Explosion.

L-1565. CLARKSBURG, W. VA., JUNE 9, 1932. Burns suffered when an "aerial bomb" exploded in his home proved fatal to one boy and resulted in serious injuries to two others. The explosive was a "dud" found in a field by the boys following a fireworks display.

Gas Explosions.

H-35333. HIGHLAND PARK, MICH., APRIL 25, 1932. Two men were killed and thirty were injured when an explosion caused by escaping gas wrecked a store and apartment building. A gas pipe in the basement had been broken while a supply of coal was being delivered, and escaping gas was ignited from a furnace fire.

L-1660. POTOMAC, MD., JUNE 23, 1932. Two persons lost their lives and another person was seriously burned when gas from a leaking main was exploded by a spark from the automobile they were starting. One of the victims was an employee of the gas company, who, after locating the leak, asked two youths to drive him back to the gas company to report it. The three were in the car when the blast, apparently caused by a spark from the exhaust or from starting the car, sent flames over an area of nearly two hundred feet and ignited the car, trees and undergrowth.

Cleaning with Gasoline.

L-1591. WORCESTER, MASS., MAY 10, 1932. A woman was burned to death when gasoline she was using to clean her husband's overalls ignited and set fire to her clothing. Fire in the stove is believed to have ignited the gasoline fumes. Her husband was burned on his arms and hands trying to save his wife.

Gasoline Used to Kindle Fire.

L-1582. PULLMAN, W. VA., MAY 18, 1932. Burns suffered when he used gasoline in kindling a fire proved fatal a week later to an elderly man. He had believed the gasoline to be kerosene.

Re-entering Burning Buildings.

L-1614. TACOMA PARK, MD., APRIL 13, 1932. After escaping from his burning house a man remembered that he had left $35 inside. He returned to an upper room for the money and lost his life when the roof collapsed.

L-1602. TANGERINE, FLA., APRIL 28, 1932. Two elderly women lost their lives and another was seriously injured when they entered a burning dwelling to save their belongings. One of the women was trapped and burned to death, another was fatally burned but escaped from the building, and the third was seriously injured when she jumped from the second floor. The three were away from home when the fire started.